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PALEONTOLOGY.—Jedria, *a new subgenus of* Naticopsis[1]. ELLIS L. YOCHELSON, U. S. Geological Survey. (Communicated by G. Arthur Cooper.)

While I was working with Dr. J. Brookes Knight and others on the Paleozoic Gastropoda section of the *Treatise on invertebrate paleontology*, it became evident that clarification of the generic conception of *Naticopsis*, together with the proposal of one new subgenus, would be desirable before publication of the treatise. The following discussion is intended to provide the needed clarification:

Naticopsis (Jedria) Yochelson, n. subg.

Genotype: *Naticopsis meeki* Knight, 1933 (p. 373).

Neritiform shells with subsutural shoulders at ephebic stage. Neanic stages moderately high spired, having evenly rounded, unornamented whorls; mature whorl profile showing a subsutural shoulder followed by a very gently concave slope to a ventricose swelling at the periphery; shoulders of some species ornamented with strong transverse lirae.

In 1933, Knight (p. 363) informally proposed the group of *Naticopsis ventrica* (Norwood and Pratten), which included that species, the genotype species of *Jedria*, and *Naticopsis scintilla* Girty. Among European species, the subgenus appears to include *Naticopsis placida* (Koninck) and *N. plicistria* (Phillips) from the Lower Carboniferous, and *N. subcostata* (Archiac and Verneuil) from the Middle Devonian. One specimen, figured by Kittl as *Naticopsis* (*Hologyra*) *declivis* (1894, pl. 4, fig. 14), from the Triassic of Austria, is doubtfully referred to this subgenus.

The genus *Naticopsis* as recognized in the Paleozoic includes those gastropods with anomphalous shells that have straight, obliquely backward outer lips. A parietal inductura more or less extended in the plane of the aperture is always present. Ontogenetic changes in species are so extreme that juveniles cannot be identified with adults except on the basis of growth series. The genus considered broadly includes species of various shapes. Although these intergrade they appear to group themselves around several major types which here are considered subgenera. At least four of these are recognized.

Naticopsis (*Jedria*) as proposed above contains those relatively high spired shells that develop a subsutural whorl shoulder at maturity. *Naticopsis* (*Planospirina*) Kittl (1899, p. 48) includes relatively low spired shells that have smoothly rounded whorls, but with the final whorl turning obliquely downward. *Naticopsis* (*Naticopsis*) McCoy (1844, p. 33) is restricted to those species of *Naticopsis* that have moderately low spired shells with a mammary apex above a smoothly rounded profile. *Naticopsis* (*Marmolatella*) Kittl (1894, p. 142) includes low spired shells having the upper whorl surface flat and extending outward. The subgenera *Planospirina* and *Marmolatella* both have Triassic genotypes and have not been used commonly in the literature on Paleozoic Neritacea. *Fedaiella* Kittl (1894, p. 139), another name based on a Triassic genotype, seems to be a synonym of *Naticopsis* s.s.

[1] Publication authorized by the Director, U. S. Geological Survey.

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PALEONTOLOGY.—Cardiniferella, *n. gen., the type of a new family of Carboniferous Ostracoda*. I. G. SOHN,[1] U. S. Geological Survey. (Communicated by J. S. Williams.)

The upper part of the Helms formation of western Texas contains an abundant ostracode fauna both in the limestones and in the interbedded shales (Sohn, 1950). These faunules, according to present-day knowledge, closely resemble the Chester ostracodes described by Cooper (1941) from Illinois. The new genus described here is restricted to the limestone beds, where it is relatively abundant as silicified specimens in insoluble residues resulting from digestion with hydrochloric acid. It has a "kirkbyan pit," a character that would place this genus in the family Kirkbyidae, were it not lacking the marginal rims that characterize genera in this family. The hingement in *Cardiniferella* is hitherto unrecorded in the Ostracoda.

Two recently published papers emphasize the variation and consequently the importance of hingement in the classification of fossil ostracodes. Levinson (1950) analyzes the hingements of several Paleozoic genera. He illustrates the hinge elements of *Ulrichia bituberculata* (McCoy) (p. 70, figs. 8a, b); this species is probably not a true *Ulrichia*, but it illustrates the hinge elements of some Kirkbyidae. Triebel (1950) analyzes the hingement of several post-Paleozoic genera, and defines (p. 313) the following types of hingement:

Merodont, only one valve dentate.
Amphidont, both valves with one or more hinge teeth.

Because *Basslerella* Kellett, 1935, from rocks of late Paleozoic age, has a merodont dentition Triebel assumes (pp. 313–314) that amphidont dentition developed from merodont. The relatively advanced amphidont hingement described in this paper does not shed any light on this assumption, because Triebel deals with genera in the family Cytheridae (suborder Podocopa). This paper deals with a new family that is in the same higher group as the Kirkbyidae, which probably belongs to a different suborder. It is premature to speculate regarding the phylogenetic relationship and evolution of the different types of dentition found in Ostracoda because the dentition of many Paleozoic genera has not as yet been worked out and because there are all too many undescribed genera that probably contain important clues to the development of the Ostracoda.

The writer is grateful to Arthur L. Bowsher, U. S. Geological Survey, for making available the insoluble residues of his collections from the Helms formation of Texas, in which the new genus occurs, and to Dr. C. C. Branson, University of Oklahoma, Norman, Okla., who collected additional material at the type locality.

CARDINIFERELLIDAE Sohn, n. fam.

Straight-backed reticulated marine ostracodes with "kirkbyan pit" and amphidont hinge.

This family differs from Kirkbyidae in hingement and in the absence of marginal ridges. *Tomiella* Spizharsky (1937, pp. 143–146, 166) differs from the Kirkbyidae in not having marginal ridges, but it does not belong in the Cardiniferellidae because of its simple hinge.

Cardiniferella Sohn, n. gen.

Type species: *C. bowsheri*, n. sp.

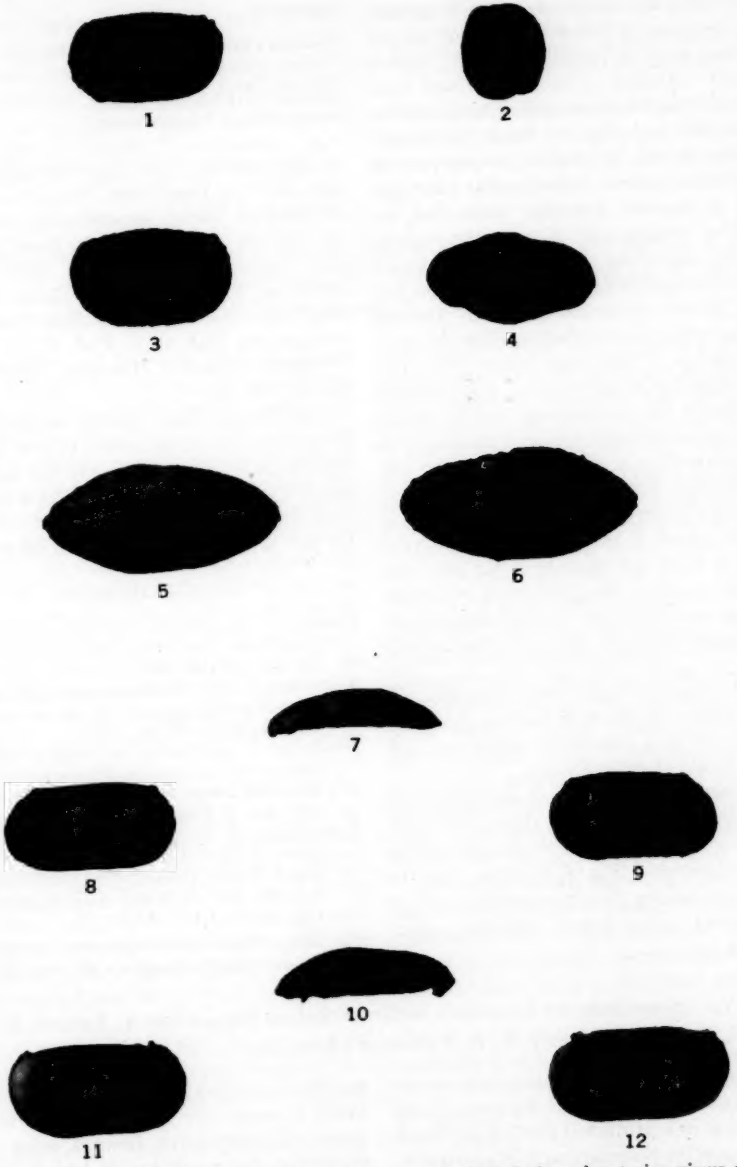
Subovate, straight-hinged ostracodes, lateral surface reticulate, except for smooth marginal area. Hinge incised, amphidont. Overlap slight, marginal area of one valve grooved to receive smaller valve. Muscle scar pit subcentrally located.

This genus differs from all previously described genera in hingement. *Amphissites* has a somewhat similar hingement in that the larger valve overlaps the accommodation groove at the ends and fits into terminal sockets that open to the outside, but the grooved or smaller valve does not have terminal teeth, thus resulting in a merodont hingement. The same features distinguish the cardiniferelloid hinge from the sansabelloid (Kloedenellidae) hinge, and from the hinges of several late Paleozoic genera placed in Leperditellidae.

Cardiniferella bowsheri Sohn, n. sp.
Figs. 1–12

Subovate in lateral view; dorsal and ventral

[1] Publication authorized by the Director, U. S. Geological Survey.



FIGS. 1–12.—*Cardiniferella bowsheri* Sohn, n. gen., n. sp.: 1, 2, Left and anterior views of paratype U.S.N.M. 118306 from U.S.N.M. loc. 3069-2 (note smooth area where reticulations were abraided, and anterior tooth of right valve); 3, 4, right and dorsal views of holotype, U.S.N.M. 118307 from U.S.G.S. loc. 10889 (3, because the specimen is tilted backward, the pit appears on the photograph to be farther towards the posterior than it actually is; 4 is oriented with anterior to the left); 5, 6, ventral and dorsal views of a smooth specimen, paratype U.S.N.M. 118308 from U.S.N.M. loc. 3070-2 (5 is oriented with anterior to left, 6 with anterior to right); 7–12, dorsal, lateral, and interior views of opposing valves of a carapace that was opened for the purpose of illustrating the hingement (7–9, left valve, 10–12, right valve, paratype U.S.N.M. 118309 from U.S.N.M. loc. 3070-2; note reflection of muscle scar pit on inside of Fig. 12; the anterior cardinal portion of fig. 10 is broken). (Magnification approx. ×30)

margins straight, subparallel. End margins curved, greatest curvature of anterior margin lower than that of posterior. Lateral surface reticulated, marginal areas and dorsum non-reticulated. Oval "kirkbyan pit" located anterior to midlength and slightly below midheight. Hingement incised, amphidont, consists of an accommodation groove in the smaller valve terminated by rounded, tenonlike teeth that are bounded by sockets that open to the outside. The dorsal edge of the overlapping valve terminated by accommodating mortiselike sockets that are open dorsally; these are flanked by terminal teeth that consist of an enlargement of the overlapping portion of the larger valve. The overlapping valve has a grooze along the marginal area to receive the bevelled edge of the smaller valve. This grooved zone is offset from the valve surface, resulting in a rimlike pleat on the outside of the valve. The smaller valve has a narrow bevelled edge bordered by a thin strip that seals the closing valves. A very narrow duplicature is suggested in many specimens by a thin zone that borders the inside of the overlapping structures of both valves. Dorsal and ventral outlines subovate, greatest convexity just in front of muscle scar pit.

Cyathus vetustus Cooper, 1941, resembles this species in outline; it differs in the hingement and in the absence of a subcentral muscle scar pit, and it is devoid of reticulations.

The preservation of many of the specimens does not show the reticulation (Figs. 5–12), but the presence of specimens with patches of the reticulations abraded (Fig. 1) indicates that the smooth forms having the characteristic outlines and hingement are conspecific with the reticulated forms.

Measurements	*Greatest length (mm)*
Holotype, Figs. 3, 4, U.S.N.M. 118307	0.81
Paratype, Figs. 1, 2, U.S.N.M. 118306	0.86
Paratype, Figs. 5, 6, U.S.N.M. 118308	1.27
Paratype, Fig. 8, U.S.N.M. 118309	0.93
Paratype, Fig. 11, U.S.N.M. 118309	0.98

Type locality.—U.S.G.S. 10889 Helms formation, El Paso quadrangle, Tex., 2½ miles west of Powwow Tanks, approximately 30° 50′ 17″ N., 106° 04′ 40″ W. Stop 13, West Texas Geol. Soc. Guidebook, Field Trip 5, 1949, and limestone bed 9, sec. "C" West Texas Geol. Soc. Field Trip May–June 1946 (stop 1 on map accompanying that trip). Coll. C. C. Branson, November 1949, A. L. Bowsher, 1948 (U.S.N.M. locality 3070-2).

Distribution.—This species is abundant also in bed 11 of the same section (U.S.N.M. locality 3070-4), and at approximately the same stratigraphic level in a saddle 1.1 miles west of Powwow Tanks, approximately 31° 50′ 16″ N., 106° 02′ 55″ W. (U.S.N.M. locality 3069-2).

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BOTANY.—*Some new combinations in Guatemalan Bromeliaceae*. LYMAN B. SMITH, Department of Botany, U. S. National Museum.

The following new combinations are necessary preliminary to the publication of the Bromeliaceae in a projected part of the Flora of Guatemala by Standley and Steyermark.

Tillandsia elongata H. B. K. var. **subimbricata** (Baker) L. B. Smith, comb. nov.
Tillandsia subimbricata Baker, Journ. Bot. **25**: 304. 1887.

In 1889 André (Brom. Andr. 96) indicated that he did not consider *Tillandsia subimbricata* specifically distinct from *T. elongata*, although he failed to make any combination for it. Subsequent collections have shown a series of intergradations that amply justify André's opinion.

Tillandsia tricolor Schlecht. & Cham. var. **melanocrater** (L. B. Smith) L. B. Smith, comb. nov.
Tillandsia melanopus E. Morr. ex Mez. in DC. Monogr. Phan. **9**: 680. 1896, in large part but not as to type.
Tillandsia melanocrater L. B. Smith, Contr. Gray Herb. **117**: 31. 1937.

When first proposed on the basis of a few collections this taxon seemed easily distinguishable from *Tillandsia tricolor*. However, recent collections from Guatemala break down all distinctions except the highly artificial one of size. It seems best, therefore, to regard *T. melanopus* as a Central American variety of the Mexican *T. tricolor*.

Vriesia montana (L. B. Smith) L. B. Smith & Pittendrigh, comb. nov.
Thecophyllum montanum L. B. Smith in Yuncker, Field Mus. Publ. Bot. **17**: 319. 1938.

The validity of the genus *Thecophyllum* will be discussed in detail in a later paper by Dr. C. S. Pittendrigh and myself, but the above combination must be made now.

ENTOMOLOGY.—*Studies in Panama* Culicoides (*Diptera: Heleidae*): I, *Descriptions of six new species.*[1] WILLIS W. WIRTH[2] and FRANKLIN S. BLANTON.[3] (Communicated by Curtis W. Sabrosky.)

This paper is the first of a short series to bring up to date our taxonomic knowledge of the Panama species of biting midges of the genus *Culicoides* Latreille. In 1951 the junior author began a comprehensive survey of the biting Diptera of Panama. It soon became apparent that the large numbers of both male and female *Culicoides* which were collected in the traps in use for this survey would afford an unexcelled opportunity for a taxonomic study. The senior author, with a great taxonomic interest in the Heleidae, and advantageously located at the U. S. National Museum, where the types of a number of Neotropical species of *Culicoides* are located, was therefore invited to join in a cooperative study.

Our efforts were greatly stimulated by the recent appearance of several important papers on the Caribbean biting midges of this genus, including papers by Barbosa (1947), Fox (1946, 1947), Macfie (1948), and Ortiz (1950, 1951). All these authors have presented keys for the identification of the Caribbean species. With the great amount of descriptive work concurrently going on, however, keys are out of date almost as soon as published. Nevertheless, they are invaluable as working tools, and in a later paper of this series we will present a key to the Panama species.

Our terminology is the same as that employed by Wirth (1952), where a more complete description of terms can be found. The most important difference between our usage and that of some other *Culicoides* workers is in our designation of the wing veins and corresponding cells according to Tillyard's modification of the Comstock-Needham system; thus veins Cu_1 and Cu_2 of older workers become M_{3+4} and Cu_1, respectively, and cell Cu_1 becomes cell M_4 (labeled in Fig. 2). Length is measured in relaxed specimens from the anterior edge of the mesonotum to the tip of the abdomen; a more reliable measurement is the wing length, which along with the costal ratio is measured from the basal arculus. Body measurements, antennal and palpal proportions, and descriptions of male genitalia are obtained from specimens cleared in pure phenol and mounted on slides in phenol-balsam mixture after gradual infiltration. By this method dried specimens can be relaxed and cleared, and the refractive index of the phenol-balsam brings out the minute details of the antennal and palpal sensoria, the female spermathecae, and the internal structures of the male genitalia. In the following descriptions no special mention is made of the rudimentary third spermatheca and sclerotized ring of the female internal reproductive organs, as they are present in all Neotropical species that we have studied.

To our knowledge Ortiz (1951) was the first to show the presence of the dense tufts of short, curved setae around the margins of disciform, hyaline sensoria at the apices of certain antennal segments. We have made a comparative study of them in our species with very promising results. These tufts are always present on the third (first flagellar)

[1] Published under the auspices of the Surgeon General, U. S. Army, who does not necessarily assume responsibility for the professional opinions expressed by the authors.

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segment, occasionally on segments 4– or 6–7, nearly always on 8, 9, and 10, but only rarely on the five distal segments except in the species with the second anterior radial cell in a light area, where they appear on some or all of these segments.

The types of our new species are deposited in the collection of the U. S. National Museum in Washington. Unless otherwise indicated, all specimens were collected by the junior author in light traps. We wish especially to acknowledge the generous assistance of Irving Fox, John Lane, and Ignacio Ortiz-Cordero in making comparisons of species or furnishing valuable opinions on certain species, and for supplying specimens for comparative study. P. A. Woke and L. E. Rozeboom furnished Panama material for study, including some specimens from series which in part formed the type series of new species described by Fox (1947) and Barbosa (1947). We also gratefully acknowledge the assistance rendered by Col. Francis P. Kintz, Surgeon, and Lt. Col. Edward J. Dehne, Chief of Preventive Medicine, United States Army Caribbean, as well as personnel of the 25th Preventive Medicine Survey Detachment.

Culicoides uniradialis Wirth and Blanton, n. sp.
Fig. 1, *a–d*

♀. Length 1.1 mm, wing 1.1 mm by 0.4 mm.

Head pruinose dark grayish brown; eyes broadly separated, bare. Antennae with flagellar segments in proportion of 25:22:22:22:20:20:20:20:20:20:20:20:30, all except apices of segments 3–10 pale, remainder dark; distal sensory tufts on segments 3, 8, 9, 10. Palpal segments (Fig. 1, *b*) in proportion of 10:20:27:10:10, third segment very slightly swollen, with a small shallow sensory pit.

Mesonotum rather narrow, color uniform light tawny brown, with numerous short, appressed, yellowish hairs; scutellum concolorous with mesonotum. Postscutellum dark pruinose brown, pleura pale with transverse median area darker. Legs brown, subapical rings on femora, bases and apices of mid and hind tibiae, and distal tarsal segments on all legs, pale.

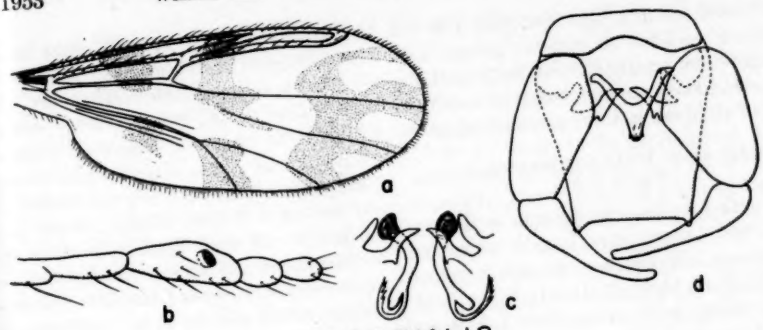
Wing (Fig. 1, *a*) with anterior radial cells not separated, the single cell long and narrow; costa to 0.75–0.8 of wing length; macrotrichia entirely absent. Wing predominantly pale yellowish, with faint, grayish, irregular bands: anterior radial cell pale except where covered by second dark wing band from a fourth of the way to halfway to apex. First dark wing band at proximal fourth of wing from costa to anterior media, interrupted and appearing again on base of vein M_{3+4} + Cu. Second band across second fourth of anterior radial cell taking in base of medial fork, interrupted and appearing again across basal half of mediocubital fork. Third band beginning as an oblique, dark mark across middle of cell R_5 from wing margin near apex of cell, broadening toward vein M_1 and extending along this vein and forming a broad dark mark in front of its apex; continuing broadly across middle of cells M_1 and M_2 to apex of vein M_{3+4} and following vein M_2 also to apex. Halteres pale.

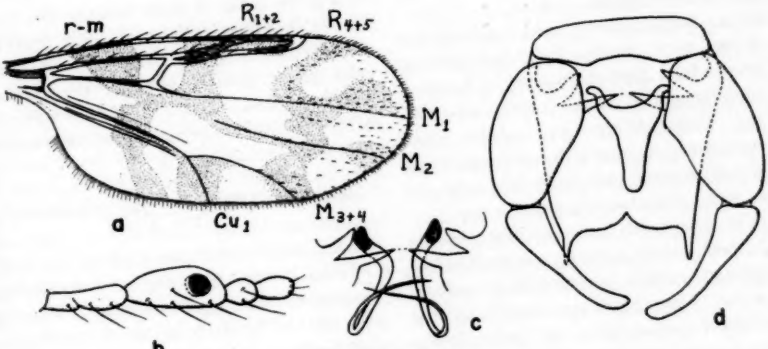
Abdomen brown; spermathecae two, small, subequal and pyriform in shape.

Male genitalia (Fig. 1, *c*, *d*). Ninth sternite very short with very shallow mesal excavation, the membrane bare; ninth tergite short, quadrate, with very small, widely separated, apicolateral processes. Basistyles stout, ventral roots stout and boat-hook shaped, dorsal roots not so long and rather stout; dististyles nearly straight, gradually tapered to tips which are blunt and not bent. Aedeagus short and stout, basal arms stout and forming anterior arch to half of total length; apex stout and rounded with faint serrations and apparently a few appressed, sharp, flattened, subapical spines. Parameres (Fig. 1, *c*) with bases knobbed; stems curved gently, each with ventral pouch about one-and-one-half times as long as its diameter, distal portions narrowed, tapered to sharp apical points with three or four subapical lateral barbs.

Holotype ♀, allotype, Mojinga Swamp, Fort Sherman, Canal Zone, October 24, 1951, F. S Blanton (light trap) (type no. 61497, U.S.N.M.). Paratypes: 12 ♂♂, 54 ♀♀, same data as type; 2 ♂♂, 2 ♀♀, Loma Boracha, C. Z., October 29, 1951.

Apparently related to the next species, *kintzi* n.sp., which it superficially resembles in its uniformly tawny yellow color, wings with costa elongated, the apex in a light area, and the dark markings of the wing reduced, diffuse, and in cell R_5, oblique. However, according to the male genitalia these species probably belong to different groups, since in *uniradialis* the ventral roots are boat-hook shaped and the parameres have a ventral pouch and distal barbs, all these being lacking in *kintzi*. The other known species, with few exceptions, which have the second





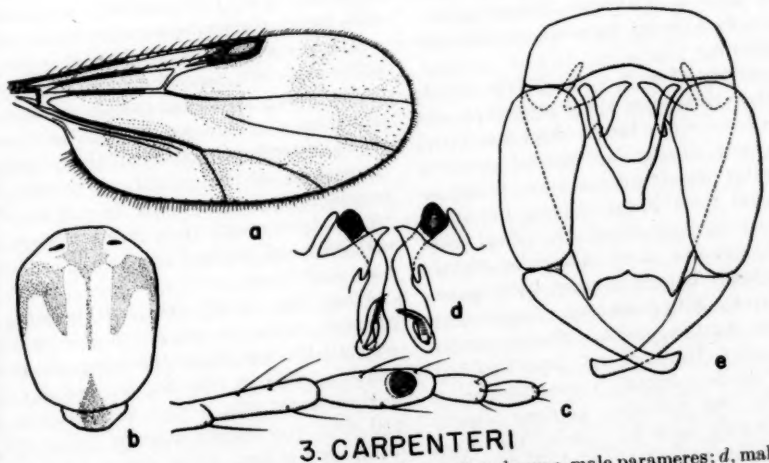


FIG. 1.—*Culicoides uniradialis: a*, Female wing; *b*, female palpus; *c*, male parameres; *d*, male genitalia, parameres removed. FIG. 2.—*Culicoides kintzi: a*, Female wing, with important veins labeled; *b*, female palpus; *c*, male parameres; *d*, male genitalia. FIG. 3.—*Culicoides carpenteri: a*, Female wing; *b*, mesonotal pattern; *c*, female palpus; *d*, male parameres; *e*, male genitalia.

anterior radial cell in a light spot belong to the well defined *pulicaris* or *guttatus* groups with characteristic and greatly different male genitalia, usually contiguous eyes and distal, sensory tufts on some or all of the last five antennal segments.

Culicoides kintzi Wirth and Blanton, n. sp.
Fig. 2, *a–d*

♀. Length 1.0 mm, wing 0.9 mm by 0.4 mm.

Head dark brown; eyes broadly separated, bare. Antennae with flagellar segments in proportion of 20:15:15:15:15:15:15:15:15:18:18:26, distal sensory tufts on segments 3, 8, 9, and 10. Palpal segments (Fig. 2, *b*) in proportion of 8:12:22:8:8, third segment moderately swollen with a small, shallow sensory pit.

Mesonotum rather narrow, color uniform dull brown, three very faintly indicated narrow, darker, longitudinal lines from level of humeral pits to scutellum, the latter concolorous with mesonotum. Postscutellum and pleura dark brown. Legs brown; femora with subapical, tibiae with sub-basal, narrow pale rings and mid and hind tibiae with apices broadly pale.

Wing (Fig. 2, *a*) with two complete anterior radial cells, both rather narrow; costa extending to 0.7 wing length; sparse macrotrichiae on distal third of wing. Wing markings practically the same as those of *uniradialis* n. sp., but only the tip of second anterior radial cell in a pale area; pale markings of wing predominant, but not to the degree found in *uniradialis*. Halteres pale.

Abdomen dark brown; spermathecae two, subequal, pyriform.

Male genitalia (Fig. 2, *c*, *d*). Ninth sternite short, with very shallow mesal excavation, the membrane bare; ninth tergite short and broad with very long, slender, apicolateral processes and a distinct mesal cleft at apex. Basistyles stout, ventral roots wedge shaped, the sharp points nearly meeting mesad, the dorsal roots shorter, curved and stout; dististyles slightly curved, gradually tapered to stout, blunt apices. Aedeagus stocky, with basal arms abruptly bent; distal portion stout, tapered to a bluntly rounded apex. Parameres (Fig. 2, *c*) with bases knobbed, stems very slender, abruptly curved just before basal fourth, the following portions slightly sinuate, abruptly bent at middle, the distal halves gradually tapered to slender, needlelike, simple points.

Holotype ♀, allotype, Mojinga Swamp, Fort Sherman, Canal Zone, October 24, 1951, F. S. Blanton (light trap) (type no. 61498, U.S.N.M.). Paratypes: 8 ♂♂, 42 ♀♀, same data except dates August 28 to November 28, 1951.

This species is superficially very similar to *uniradialis* n. sp., but is readily distinguished from it by the two completely formed radial cells, shorter costa, macrotrichiae at wing tips, and in the male, by the long apicolateral processes of the ninth tergite, slender, simple parameres, aedeagus with short basal arch and by the shape of the dorsal and ventral roots of the basistyles. *Culicoides pachymerus* Lutz, described from Amazonas, Brazil, appears to be closely related in the general wing pattern and in the shapes of the anterior radial cells, but the description is too scanty to make a close comparison. In *pachymerus*, however, the dark wing markings are more extensive and the fore and hind tibiae are said to be greatly swollen. We dedicate this species to Col. Francis B. Kintz, Surgeon of the U. S. Army Caribbean, whose cooperation made this study possible.

Culicoides carpenteri Wirth and Blanton, n. sp.
Fig. 3, *a–e*

♀. Length 1 mm, wing 1.0 mm by 0.45 mm.

Head brown, eyes narrowly separated, bare. Antennae with flagellar segments in proportion of 20:15:18:18:18:18:18:18:30:30:35:40:50, distal sensory tufts on segments 3, 11, 12, 13, 14. Palpal segments (Fig. 3, *c*) in proportion of 10:40:30:12:12, third segment scarcely swollen, with broad, shallow, sensory pit near apex.

Mesonotum (Fig. 3, *b*) elongate; color tawny yellowish brown, anterior portion except humeri darker brown and a fine median line and a sublateral pair of broader longitudinal bands of brown extending caudad to about middle of mesonotum. Scutellum dark in middle; postscutellum and pleura dark brown. Legs dark brown, femora with basal and subapical, tibiae with sub-basal and hind tibiae with apical, rather wide, pale bands.

Wing (Fig. 3, *a*) with anterior radial cells complete, narrow; costa to 0.6 of wing length; macrotrichia very sparse, appearing only on distal fourth of wing in cells R_5, M_1, and M_2. Wing predominantly pale, a very dark, blackish, stigmal spot over second anterior radial cell and distal third of first; diffuse dark patches on wing just proximad of broad pale area around crossvein r-m, over vein M_{3+4}, Cu_1 midway between base and fork, halfway across cell R_5 behind stigmal spot, across middle of distal half of cell R_5 and continued along vein M_1 to wing tip

forming an oval pale spot at apex of cell R_5 at wing margin; narrowly at medial fork and across basal half of mediocubital fork and subapically across cell M_1 and M_2, cutting off semicircular, apical spots in these cells at wing margin. Halteres pale.

Abdomen whitish on basal half above, light brown elsewhere; spermathecae two, slightly unequal, ovoid to slightly pyriform, the bases of the ducts sclerotized for a distance of a fourth of length of spermathecae.

Male genitalia (fig. 3, *d*, *e*). Ninth sternite short with shallow mesal excavation, the posterior membrane bare; ninth tergite tapered to a pair of broadly separated, triangular apicolateral processes. Basistyles with ventral roots large and boat-hook shaped, their apices nearly touching mesad, dorsal roots nearly as long, slender; dististyles slightly curved, slender, with slightly enlarged, pointed apices. Aedeagus with basal arch rounded, extending to two-thirds of total length, the very short distal portion broad with truncated apex. Parameres (Fig. 3, *d*) with knobbed bases, rather stout stems bent at about half their lengths, each with a distoventral pouch of same diameter as stem and about 1.5 times as long; apical portions about half the diameter of stems, tapered to pointed apices and each with a subapical fringe of about a dozen very fine hairs.

Holotype ♀, Madden Dam, Canal Zone, June 6, 1951, F. S. Blanton (light trap) (type no. 61500, U.S.N.M.). Allotype, Mojinga Swamp, Fort Sherman, C. Z., December 10, 1951. Paratypes: 16 ♀♀, same data as holotype; 24 ♀♀, same data as allotype, except dates August 15 to December 10, 1951; 1 ♀, Loma Boracha, C. Z., October 23, 1951; 2 ♀♀, Fort Sherman, C. Z., June 7, 1951; 1 ♀, Barro Colorado Island, January–March 1944, J. Zetek.

The Barro Colorado Island specimen was included by Barbosa as a paratype of *panamensis*, which however, is a much different species, with a light spot straddling vein M_2 of the wing. *C. carpenteri* might be confused with pale specimens of *galindoi* n. sp., but by microscopic examination of the female palpi and male genitalia the two species may readily be separated. We are pleased to have the opportunity to name this species in honor of Col. Stanley J. Carpenter, formerly entomologist for the U. S. Army Caribbean, whose interest in the Panama *Culicoides* problem gave great impetus to this project.

Culicoides galindoi Wirth and Blanton, n. sp.
Fig. 4, *a–f*

♀. Length 1.0 mm, wing 0.9 mm by 0.38 mm.

Head brown; eyes contiguous, bare. Antennae with flagellar segments in proportion of 20:15:15:15:15:15:15:25:25:30:30:40, distal sensory tufts on segments 3, 7, 8, 9, 10. Palpal segments (Fig. 4, *c*) in proportion of 10:20:20:8:10, third segment slightly swollen, with well developed subapical sensory pit.

Mesonotum (Fig. 4, *b*) rich brown, on anterior half with extensive pruinose yellowish brown markings; principally a large pair of submedian patches and two sublateral pairs of smaller spots; posterior half almost entirely pale; scutellum dark in middle. Postscutellum and pleura dark brown, almost black. Legs dark brown, fore and mid femora with subapical, and all tibiae with subbasal, narrow pale rings.

Wing (Fig. 4, *a*) nearly bare, sparse macrotrichia distad of level from end of costa to end of vein M_{3+4}; anterior radial cells short, complete, costa to 0.6 of wing length. Second anterior radial cell and distal half of first included in a very dark spot; a very light spot over r-m crossvein from anterior wing margin to level of anterior media; a double light spot in cell R_5 at end of costa, a very large rounded light spot at apex of cell R_5, broadly meeting wing margin and usually continued along it a little way toward wing tip; two long light spots in cell M_1, the second broadly meeting wing margin; base of cell M_2 with continuous light streak to transverse dark band at level of end of vein M_{3+4} and a broad apical light spot at wing margin; base of anal cell pale and a large double light spot at apex. Halteres pale.

Abdomen dull, brownish black; spermathecae two, subequal, pyriform (Fig. 4, *d*).

Male genitalia (Fig. 4, *e*, *f*). Ninth sternite very short, with shallow mesal excavation, the membrane spiculate; ninth tergite short and strongly tapered, with very short, triangular, apicolateral processes. Basistyles stout, dorsal roots slender, ventral roots longer and boat-hook shaped; their apices contiguous mesad; dististyles slender, with curved, pointed apices. Aedeagus with strong basal arch, the basal arms slender and curved, apex a short, rounded lobe. Parameres (Fig. 4, *e*) with crooked, knobbed bases, the stems slender and slightly sinuate, the apices abruptly recurved ventrad, each with three subapical lateral barbs.

Holotype ♀, allotype, Mojinga Swamp, Fort Sherman, Canal Zone, October 24, 1951; F. S. Blanton (light trap) (type no. 61501, U.S.N.M.). Paratypes: 26 ♂♂, 38 ♀♀, same data as types, except dates August 15 to October 24, 1951; 1 ♀, Cerro Campaña, Panama Prov., July 3, 1951; 1 ♀, Pacora, Panama Prov., June 4, 1951; 2 ♂♂, 1 ♀, Madden Dam, C. Z., September 21, 1951; 1 ♀, Arraijan, Panama Prov., August 8, 1951; 9 ♂♂, 13 ♀♀, Loma Boracha, C. Z., October 29, 1951.

Culicoides limai Barretto, from São Paulo, Brazil, is very similar but has a small ventral lobe on the male parameres, the basal arch of the aedeagus is narrower, the mesonotum has only a pair of small, anterior, sublateral pale patches; the scutellum is dark on the extreme ends as well as in the middle, and the tibiae have subapical pale bands on the fore and mid legs and at the bases and apices of the hind pair. From the original description, *wokei* Fox might be confused with *galindoi*, but Fox's species is larger, the mesonotum has a faintly mottled pattern of punctiform dots and the wing is nearly bare with the markings very faint and diffuse. This species is named in honor of Dr. Pedro Galindo, of the Gorgas Memorial Laboratory, one of the leaders of the Panamanian Republic in the work on Diptera of medical importance.

Culicoides vargasi Wirth and Blanton, n. sp.
Fig. 5, *a–e*

♀. Length 1.0 mm, wing 0.9 mm by 0.42 mm.

Head pruinose dark brown; eyes nearly contiguous, bare. Antennae with flagellar segments in proportion of 15:12:12:12:12:12:12:12:20: 22:25:28:36, distal sensory tufts on segments 3 and 7–10. Palpal segments (Fig. 5, *c*) in proportion of 8:12:25:9:11, third segment swollen with a broad, shallow, subapical, sensory pit.

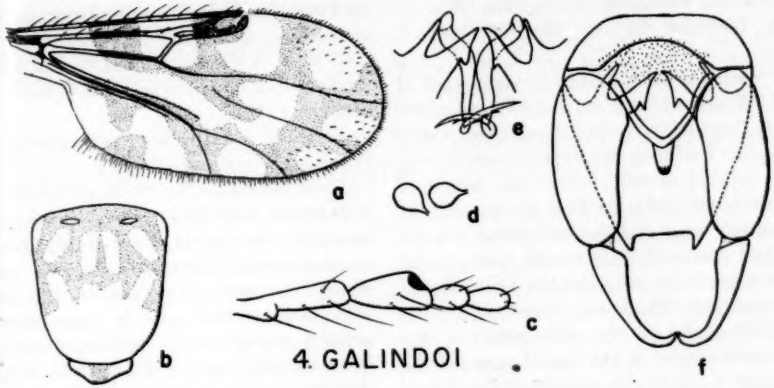
Mesonotum (Fig. 5, *b*) dark brown, with prominent pattern of large, pruinose gray patches, including a large, contiguous, quadrate pair in middle before suture, a pair of rounded spots over humeral pits, three pairs of rounded, lateral spots and quadrate prescutellar sensory areas margined with gray. Scutellum gray, brown in middle. Legs brown, femora with subapical and tibiae with subbasal pale bands, hind tibiae with apices broadly pale.

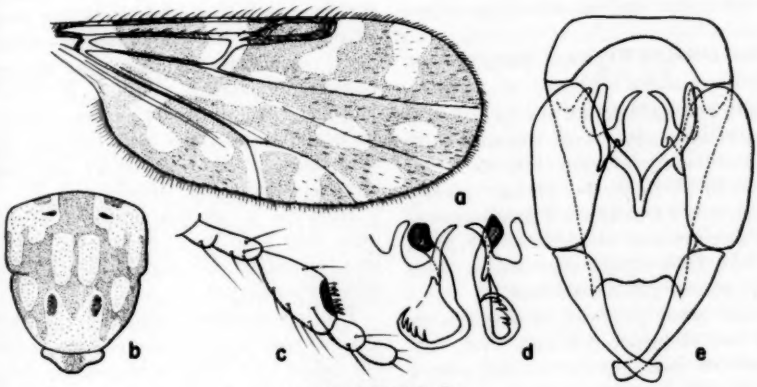
Wing (Fig. 5, *a*) with anterior radial cells normal, short; costa to 0.6 of wing length; macrotrichia very sparse and in rows over distal third of wing, a few in anal cell. Prominent yellow spots on anterior wing margin at wing base and over r-m crossvein, the latter spot extending to slightly behind anterior media, the area between these two spots and a stigmal spot over second anterior radial cell and distal half of first very dark. Cell R_5 with two hourglass-shaped, transverse light spots, the first just past end of costa, often divided into two separate, round spots, the second midway between this one and wing tip, both broadly meeting wing margin; cell R_5 also with two linear pale spots on anterior side of vein M_1, the first one short, midway between pale spot over r-m crossvein and one at end of costa, the second extending between posterior ends of the two anterior pale spots in cell R_5. Apices of veins M_1 and M_2 pale margined; a prominent light spot straddling middle of vein M_2; small, rounded, submarginal light spots in cells M_1 and M_2; cell M_2 also with a large light spot behind medial fork and a small light spot just in front of mediocubital fork; veins M_{3+4} and Cu_1 entirely pale margined, the latter broadly so, the former broadly connected to a large light spot in cell M_4 which broadly meets wing margin midway of cell, anal cell with basal pale spot connected to pale areas at base of cell M_2 and with a single, round light spot just behind mediocubital fork. Halteres pale.

Abdomen dark brown; spermathecae two, subequal, pyriform.

Male genitalia (Fig. 5, *d*, *e*). Ninth sternite with broad, deep, mesal excavation, the posterior membrane bare; ninth tergite long and tapered, the apicolateral processes short and triangular. Basistyles with ventral roots long, curved and slender, with small caudal hook; dorsal roots almost as long; dististyles slender and slightly curved. Aedeagus with basal arms broadly separate to two-thirds of total length, the fork angular, a pair of short, bladelike processes on caudal side of shoulders of basal arms; distal portion slender, with rounded apex with faint serrations. Parameres (Fig. 5, *d*) with large basal knobs, stems slender and nearly straight, abruptly recurved at distal three-fifths with apices narrowed and each bearing a fringe of 4–5 sharp spines and a strong, bent, distal spine.

Holotype ♀, allotype, Las Tablas, Los Santos Prov., Panama, June 14, 1951, F. S. Blanton (light trap) (type no. 61502, U.S.N.M.). Paratypes: 9 ♂♂, 10 ♀♀, same data as type; 12 ♂♂, 59 ♀♀, Mojinga Swamp, Fort Sherman, C. Z., August 28, 1951 to January 1952; 1 ♂, Río Hato, Cocle Prov., September 24, 1951.





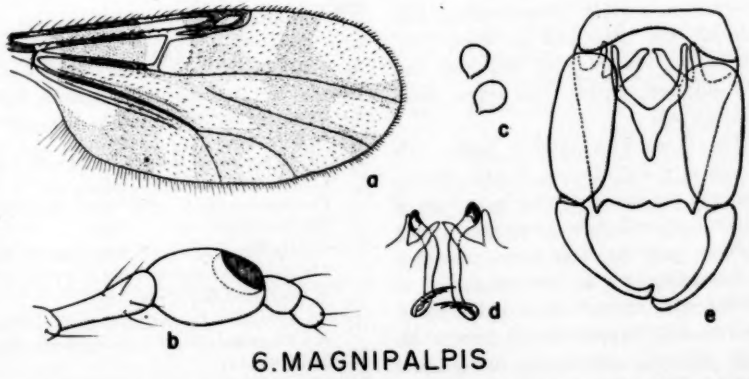


FIG. 4.—*Culicoides galindoi: a*, Female wing; *b*, mesonotal pattern; *c*, female palpus; *d*, female spermathecae; *e*, male parameres; *f*, male genitalia. FIG. 5.—*Culicoides vargasi: a*, Female wing; *b*, mesonotal pattern; *c*, female palpus; *d*, male parameres; *e*, male genitalia. FIG. 6.—*Culicoides magnipalpis: a*, Female wing; *b*, female palpus; *c*, female spermathecae; *d*, male parameres; *e*, male genitalia.

Other material examined: VENEZUELA, 3 ♂♂, 11 ♀♀, Ocumare del Tuy, May 28, 1951, I. Ortiz.

This species is the Neotropical counterpart of *baueri* Hoffman, which it very closely resembles. In *baueri*, described from Maryland, there is only one pale line bordering the anterior side of vein M_1, this located directly behind the light spot at the end of the costa; the hind femora lack the subapical pale rings and the hind tibiae lack the apical pale bands; the pit on the third palpal segment is small and deep and the spermathecae are subspherical. There are, however, no important differences in the male genitalia. We dedicate this species to Dr. Luis Vargas, of the Instituto de Salubridad y Enfermedades Tropicales, México, D. F., México, a very enthusiastic and esteemed worker on Neotropical *Culicoides*.

Culicoides magnipalpis Wirth and Blanton, n. sp. Fig. 6, *a–e*

♀. Length 1.1 mm, wing 1.0 mm by 0.48 mm.

Head dark brown; eyes bare. Antennae with flagellar segments in proportion of 20:15:18:20:20:20:20:20:25:25:25:30:40, distal sensory tufts on segments 3 and 11–15. Palpal segments (Fig. 6, *b*) in proportion of 10:20:30:8:7, third segment remarkably bulbously swollen with broad, deep, sensory pit on distal half.

Mesonotum tawny yellowish brown, a faint, contiguous pair of lighter yellowish, oval, submedian spots on disc; humeral corners with a small pair of whitish spots; area between these and sensory pits blackish; scutellum tawny, slightly darker in middle. Postscutellum and pleura blackish, the latter pale on upper half. Legs dark brown, femora with subapical and tibiae with subbasal, narrow pale rings, distal tarsal segments pale.

Wing (Fig. 6, *a*) with anterior radial cells complete: costa to 0.6 of wing length: macrotrichia long and numerous, extending to base of wing except in basal cell. Anterior margin of wing with yellowish spots at wing base, over r-m crossvein (extending only to anterior media), a large rounded spot at end of second anterior radial cell extending two-thirds way to vein M_1 and a large pale oval spot nearly filling distal half of cell R_5 past level of end of costa. Cell M_1 with two light spots, the distal one broadly attaining wing margin: cell M_2 with a long pale spot just ahead of mediocubital fork, and a second rounded spot broadly attaining wing margin. Cell M_4 with a large rounded spot in distal half: anal cell with one large pale spot in distal portion. Halteres pale.

Abdomen dark brown: spermathecae (Fig. 6, *c*) two, subequal, subspherical.

Male genitalia (Fig. 6, *d*, *e*). Ninth sternite with broad, deep mesal excavation, the posterior membrane bare: ninth tergite slightly longer than basal breadth, apicolateral processes short and widely separated, a slight median cleft. Basistyles with ventral roots slightly foot-shaped, their pointed apices nearly meeting mesad; dorsal roots slightly shorter, slender and simple; dististyles slender, slightly curved, their apices bent and pointed. Aedeagus with basal arch to slightly over half of total length, the basal arms stout and bent midway forming a rooflike arch; distal portion stout at base, apex narrower and rounded. Parameres (Fig. 7, *d*) with bases knobbed, stems slender, bent near bases, middle portions straight, then bent outward and then ventromesad with tips slender and needlelike and each bearing four lateral barbs.

Holotype ♀, allotype, Cerro Campaña, Panama, July 3, 1951, F. S. Blanton (light trap) (type no. 61503, U.S.N.M.). Paratypes: 4 ♀♀, same data as type.

This species takes its place near the *debilipalpis* group of species on the basis of its wing markings, but differs from them in having the distal light spots attaining the wing margin in cells R_5, M_2, and M_4, and the third palpal segment is very distinctively swollen.

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ENTOMOLOGY.—Wenzella obscura, *a new genus and new species of flea from Guatemala* (*Siphonaptera*).[1] ROBERT TRAUB, Lt. Col., MSC.[2]

The siphonapteran fauna of Guatemalan rodents, although of potential medical significance, is relatively little known. Among the excellent ectoparasites collected by a Chicago Natural History Museum expedition to Guatemala in 1948, is the remarkable flea here described as a new genus of the family Hystrichopsyllidae, subfamily Rhadinopsyllinae.

Wenzella, n. gen.

Diagnosis.—Differs from all known rhadinopsylline genera in *each* of the following characteristics: Pronotal comb lacking; antenna with a conspicuous flange (Fig. 1, *A.F.*) extending from base to near apex of club, ensheathing much of first two segments; lacking even vestiges of abdominal comb of spinelets on terga two through six; prosternosome without a sinus to receive the small first vinculum (*VC.1*); fourth vinculum distinct (Fig. 10, *VC.4*); male with three antesensiliary bristles; male eighth tergum (Fig. 7, *8T.*) very large, inclosing much of genitalia; maxillary palpi (Fig. 1, *M.P.*) very long, extending to apex of foretrochanters, suggesting *Megarthroglossus* of Anomiopsyllinae.

Agrees with *Stenischia* Jordan, 1932, in that the lateral metanotal area is not set off as a distinct sclerite, and instead the metanotum extends as a downward-directed long vertical triangle between metepisternum and metepimere.[3] Differs from other members of the subfamily (except *Trichopsylloides* Ewing, 1938) in lacking a genal ctenidium.

Description.—Caput integrecipitate, with internal but distinct tubercle (Fig. 1, *TB.*). Anterior and dorsal margins of head evenly and very broadly convex, not rounded; in female, those margins straighter. Genal region (*GN.*) extending downward beyond mid-point of maxillary lobe. Head chaetotaxy reduced in number and size of bristles, which are not set in distinct rows; postantennal region with but one row of bristles, that marginal. Eye greatly reduced. Palpi (*L.P.*) 5-segmented, not extending beyond apex of forecoxae, much shorter than elongate maxillary palpi. Antenna peculiar in position and shape; although genus is integrecipitate in both sexes, in each sex the base of antenna is removed from crown of head (in other integrecipitate fleas, that of male is usually near top of head); antennal groove not definitely extending onto propleuron; first antennal segment directed anteriorly, almost horizontal, not pointing ventrad as is typical in other fleas; club almost rhomboidal, scarcely narrowed apically, its segments often partially fused, some reduced in size; club apparently consisting of seven or eight segments (actually nine present); with a conspicuous triangular flange. First vinculum (*VC.1*) relatively broad. Margin of prosternosome straight, unmodified at level of insertion of this vinculum. Tentorial bridge (*T.BR.*) unusual in being displaced caudad, near vinculum (overlapping in specimen drawn); vermiform. Pronotum with but one complete row of bristles, those short; comb completely absent. Mesonotum (Fig. 10, *MSN.*) with two rows of bristles, the first somewhat irregular; with a relatively long, well-developed phragma (*PH.2*); with two or three pseudosetae (*PS.S.*). Mesepisternum (*MPS.*) with anterior margin fairly straight. An internal furca (*I.F.2*) conspicuous, extending dorsad more than half height of mesepimere (*MPM.*). Mesepimere longer than broad (high), much longer than *MPS.* Mesosternosome (*MPS.* and *MPM.*) with chaetotaxy reduced to about four bristles. Metanotum (*MTN.*) with a distinctive beak-shaped conspicuous phragma (*PH.3*) (not as broad as that of mesonotum); with two rows of bristles; about

[1] Published under the auspices of the Surgeon General, Department of the Army, who does not necessarily assume responsibility for the professional opinions expressed by the author.

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[3] In *Trichopsylloides* Ewing the metanotum is similarly downward-directed, but the lateral metanotal area is fairly well defined.

as long as mesonotum and about half again as long as pronotum (ignoring phragma). Sides of metanotum extending ventrad as a downward-pointing triangle, the altitude of the triangle about equal to that of rest of notum above it. Lateral metanotal area completely absent. Pleural arch absent. Lower margins of metanotum heavily sclerotized, as is posterior margin of metepisternum (*MTS.*). Metepisternum (*MTS.*) with anterior margin ventrally straight, its upper portion concave. With a conspicuous internal furca (*I.F.3*) arising from base of *MTS.* Squamulum absent. Metepimere (*MTM.*) well developed, broader than long; lacking a striarium; chaetotaxy relatively reduced; apparently not fused with metanotum, although margins contiguous.

Metacoxa lacking the subapical patch of spiniforms or subspiniform bristles characteristic of the subfamily (also missing in *Trichopsylloides* Ewing, 1938, and in *Paratyphloceras* Ewing, 1940). Tibial comb absent. Profemur without thin lateral or mesal bristles. Fifth tarsal segment on each leg with four pairs of lateral plantar bristles, the apical pair somewhat reduced.

Typical terga with two rows of bristles. Second abdominal sternum without a striarium. With three antesensiliary bristles (Fig. 7, *A.B.*) in each sex; the bristles relatively unmodified; the plate supporting these bristles unusual in being displaced from dorsal and caudal margins. Abdominal spiracles much longer than broad.

Male eighth tergum extending beyond base of clasper. Male eighth sternum very large, with many bristles. Movable finger (Fig. 9, *F.*) long and narrow, without spiniforms. Ninth sternum with distal arm (Fig. 7, *D.A.9* and fig. 5) bearing subspiniforms; proximal arm (*P.A.9*) weakly sclerotized. Aedeagus relatively unmodified; with pouch wall (Fig. 8, *P.W.*) lightly sclerotized. Anal stylet (Fig. 2, *A.S.*) of female with a long apical bristle and dorsal and ventral subapical bristles. Sensilium somewhat convex. Abdominal bristles (particularly those of male eighth sternum) set in prominent bases (Figs. 6 and 4).

Genotype: *Wenzella obscura*, n. sp. The genus is named for Rupert L. Wenzel, curator of insects, Chicago Natural History Museum, who has contributed very much to the study of ectoparasites and who organized and led the expedition which collected this exceptionally interesting flea.

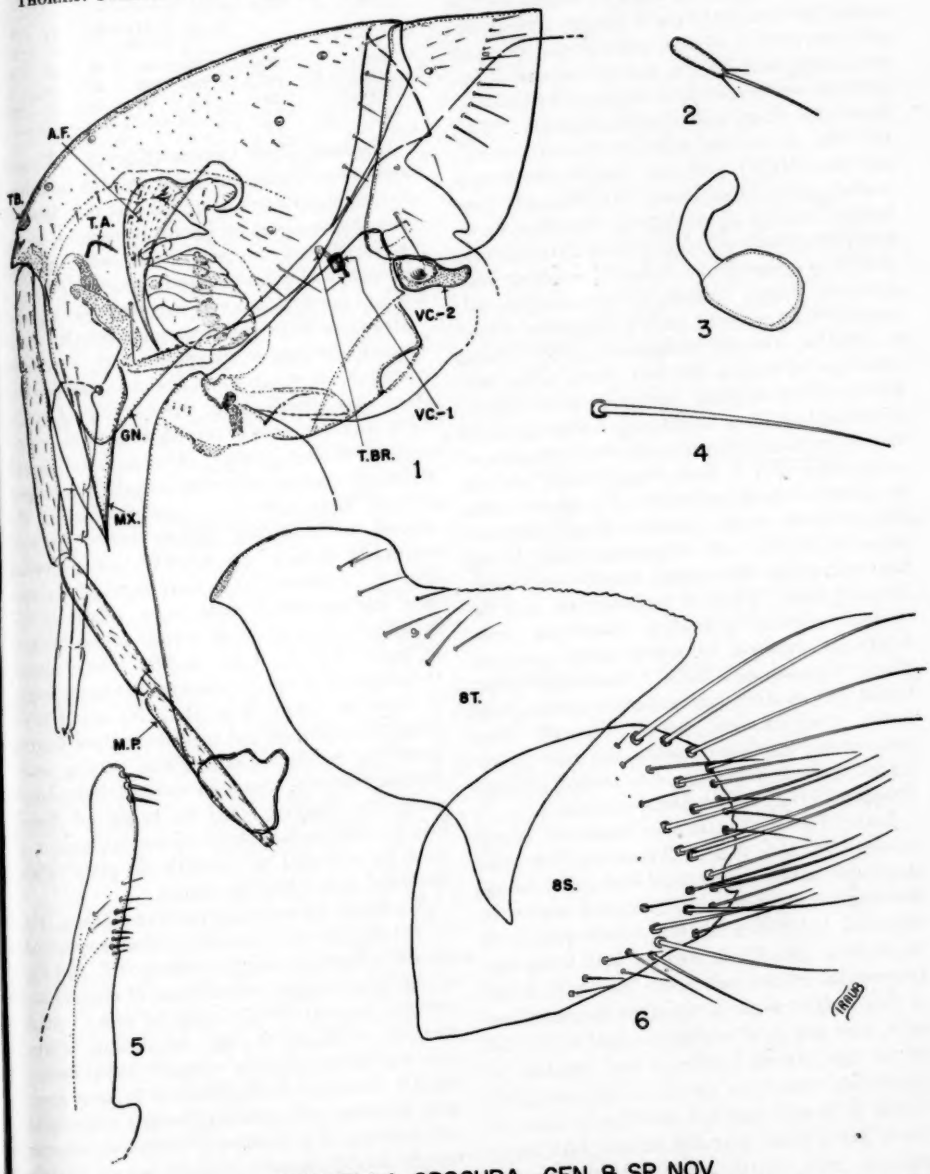
Wenzella obscura, n. sp. (Figs. 1–11)

Types.—Holotype male and allotype female *ex Heteromys d. desmarestianus* Grey (family Heteromyidae), a spiny pocket mouse; Guatemala: Sacatepequez, 6 km west of Mixco; elevation, 6,900 feet; collected by R. Mitchell and L. de la Torre; June 26, 1948. Six male and five female paratypes with same data. Holotype and allotype deposited in collections of the Chicago Natural History Museum. Paratypes deposited in the United States National Museum; the British Museum (Tring); the Division of Entomology, Department of Agriculture, Ottawa, Canada; the Chicago Natural History Museum; and the author's collection.

Description.—HEAD, MALE (Fig. 1): Anterior margin of head a shallow arc; in female nearly straight so that head is almost pointed. Preantennal region with a vestige of a row of seven or eight rudimentary bristles or hairs extending from insertion of maxillary palpi to antennal groove; with an "ocular" row of two small bristles, one near antennal groove and the other ventromarginal; with about eight to ten thin hairs scattered on rest of genal area. Anterior arm of tentorium (*T.A.*) visible on each side as an angled vermiform structure. Eye absent. Maxillary lobe (*MX.*) extending to near apex of second segment of maxillary palpus (*M.P.*). Gena (*GN.*) conspicuous, produced downward as a flap on each side, extending to near midpoint of second segment of maxillary palpus. True genal lobe (at area of junction with antennal groove) inconspicuous. Second segment of maxillary palpi about twice the length of first, larger than third, and subequal in length to fourth, which extends to about apex of foretrochanters. The labial palpi weakly sclerotized, extending to about apex of forecoxae. Postantennal region with very small thin vestigial bristles or hairs, pattern suggesting vestigial rows arranged 4-5-5, those of last row longest although still small; in addition, a patch of about 11 similar bristles near antennal groove; longest postantennal bristle at ventrocaudal angle. First segment of antenna with three to five tiny hairs at base and three or four scattered marginal hairs. Second segment bonnet-shaped, with one or two lateral bristles and a marginal row of hairs; the segment directed ventrad. Club of antenna rhomboidal but with ventral margin slightly convex apically; club about three-fourths as broad as long; with nine compact segments partially fused so that joints are inapparent, appearing to have merely seven or eight segments. Antennal flange covering most of second segment and extending beyond midpoint of club. First

vinculum or link plate (*VC.1*) less than twice as long as broad, anterior and posterior margins more sclerotized than remainder of link plate.

THORAX: Pronotum with first row of bristles shorter than second, extending down to about mid-point of segment. In addition, with two bristles near anteroventral angle. In each sex, prosternosome with an indication of a sinus for



WENZELLA OBSCURA GEN. & SP. NOV.

FIG. 1.—Head and prothorax, male. FIG. 2.—Anal stylet. FIG. 3.—Spermatheca. FIG. 4.—Bristle of male eighth tergum. FIG. 5.—Distal arm of male ninth sternum. FIG. 6.—Eighth tergum and eighth sternum, male.

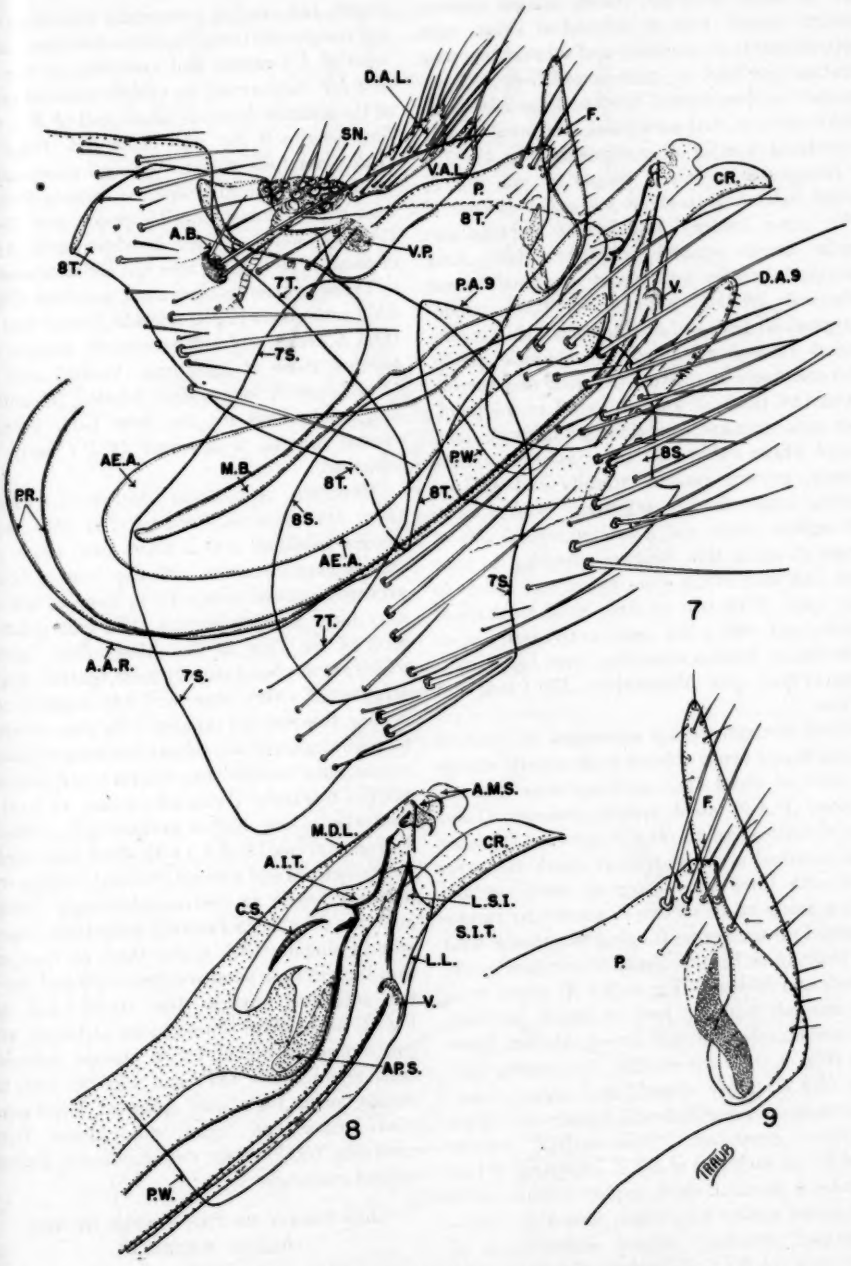
receipt of antennal club. Mesonotum (Fig. 10, *MSN.*) three-fourths as long as broad, excluding the conspicuous, cephalad-directed phragma (*PH.2*); mesonotal phragma triangular, its anterior margin extending down to ventral sixth of notum and then with base of triangle emarginate; with two rows of bristles, anterior row short and terminating near level of anterior lucodisc (*LD.*); posterior row terminating above second lucodisc. Mesonotal flange with three pseudosetae (*PS.S.*) per side, all inserted above mid-point. Mesepisternum (*MPS.*) with one bristle near ventrocaudal angle. Mesepimere (*MPM.*) with three bristles, two of these ventral, the third above insertion of third vinculum (*VC.3*). Internal furca (*I.F.2*) of mesosternum irregular, relatively conspicuous, arising caudad to mesosternal rod; broad at base; apically narrow; extending dorsad to level of spiracle. Metanotum (*MTN.*) with two rows of bristles, the first short; about two-thirds as long as broad (measured at maximum, including breadth or height from dorsal margin to apex of ventral triangular extension); phragma of metanotum (*PH.3*) beak-shaped, about as long as broad; without indication of a lateral metanotal sclerite; apical spinelets absent. Mesepisternum (*MTS.*) with a caudomarginal bristle near mid-point; this margin heavily sclerotized. Internal furca (*I.F.3*) of metasternum well developed, vertical, extending about one third height of segment, narrowed above proximal third. Metepimere (*MTM.*) somewhat rhomboidal, but caudal margins slightly sinuate, very broad, i.e., breadth (height) greater than metanotum; with four bristles, two near bullet-headed spiracle, remaining two median. Fourth vinculum (*VC.4*), or link plate, vermiform.

Legs: Forecoxa with thin scattered lateral bristles from base to apex. Mesocoxa with basal two thirds naked; apical third with a few lateral submarginal stout bristles. Metacoxa similar to mesocoxa but with a few thin submarginal hairs on proximal two thirds. Femora with three ventromarginal bristles near apex. Tibia with a row of thin bristles flanking the stout dorsomarginal ones; these last stout bristles arranged 1-2-1-2-2-3 on all legs. Apical bristle of first segment of metatarsus reaching to apex of second; one apical bristle of second segment reaching to apex of third. Tarsal claws long and narrow; fifth tarsal segment with fourth lateral plantar bristles thinner and shorter than others; the fifth plantar bristle represented by a hair. Measurements (in microns) of tibiae and segments of tarsi (petiolate base deleted) of holotype are as follows:

Leg	Tibia	Tarsal Segments				
		I	II	III	IV	V
Pro-	125	60	50	40	35	80
Meso-	180	120	75	50	35	90
Meta-	225	200	125	70	40	100

Abdomen: First tergum (Fig. 10, *1T.*) with two rows of bristles, at times with an additional subdorsal bristle preceding the first row; first row extending to about mid-point of tergum; second row longer; with vestiges of two apical spinelets on flange; with a beak-shaped phragma (*PH.1T.*) one and one-half times as long as broad at base; with two or three ventromarginal bristles. Basal sternum lacking a striarium; with a ventromarginal row of four to six or eight small bristles; other unmodified sterna with a row of six to eight long thin bristles preceded by three or four rows of shorter bristles: in instance of second sterna these anterior bristles irregularly arranged. Typical terga with two rows of bristles, the second row extending slightly below the sublanceolate spiracle, the anterior row somewhat shorter. Antesensiliary (antepygidial) bristles long and narrow in both sexes, relatively unmodified and resembling normal tergal bristles; in male (Fig. 7, *A.B.*) middle bristle almost thrice length of upper bristle; about twice length of lower; in female (Fig. 11, *A.B.*) about twice length of uppermost but ventral one three-fourths length of middle bristle. Plate bearing antesensiliary bristles displaced ventrad from dorsal margin a distance equal to length of dorsal bristle; displaced anterior of caudal margin a distance subequal to breadth of plate. Plate displaced even further in female.

Modified Abdominal Segments, Male (Fig. 7): Setal bases of abdominal bristles pronounced, heavily sclerotized. Eighth tergum (*8T.* and Fig. 6) extending caudad beyond base of digitoid and ventrad to level of base of distal arm of ninth sternum; with about eight small thin bristles near and below subovate spiracle; dorsal margin slightly crenulate from sensilium to near apex; with anterior and posterior margins convergent and meeting in a triangular extension; anterior margin doubly sinuate; posterior margin slightly concave. Eighth sternum (*8S.* and Fig. 6) large, extending dorsad to near apex of proximal arm of ninth sternum and caudad to middle of distal



WENZELLA OBSCURA GEN. & SP. NOV.

FIG. 7.—Modified abdominal segments, male. FIG. 8.—Apical portion of aedeagus. FIG. 9.—Immovable process and digitoid of clasper.

arm of ninth sternum; dorsal margin convex; caudal margin with a subventral sinus; with approximately 21 marginal and submarginal long bristles from base to apex; in addition, with six smaller ventromarginal bristles; long bristles on eighth sternum with setal bases even more heavily sclerotized than on other segments (Fig. 4).

Immovable process of clasper (*P.* and Fig. 9) broad, extending to about mid-point of digitoid (*F.*); apex broadly rounded or subtruncate; caudal margin sinuate; with three fairly long subapical bristles and about six small mesal subapical bristles; with about three caudomarginal bristles; two or three small thin mediolateral bristles proximad of subapical patch. Movable finger or digitoid (*F.*) long and narrow, about five times as long as broad at midpoint; apex subacuminate; caudal margin fairly straight, except where curving at base; anterior margin sinuate, curving caudad apically and at base curving rather sharply anteriorly; with a small thin apical bristle and a caudomarginal row of about 12 small thin bristles extending to near base, but with a gap from apical two thirds to near apex. With two or three similar subapical bristles and with a few small anteromarginal or submarginal bristles extending from below midpoint to near apex. Manubrium (*MB.*) long and narrow.

Ninth sternum weakly sclerotized for most of its length and hence difficult to see clearly except for apex of distal arm; proximal arm of ninth sternum (*P.A.9*) broad, apically truncate. Distal arm of ninth sternum (*D.A.9* and Fig. 5) longer than proximal arm and apically much narrower: apex with three caudomarginal supspiniforms; with a group of about five or six similar caudomarginal subspiniforms at apical two thirds; with two short thick bristles distad of proximal patch.

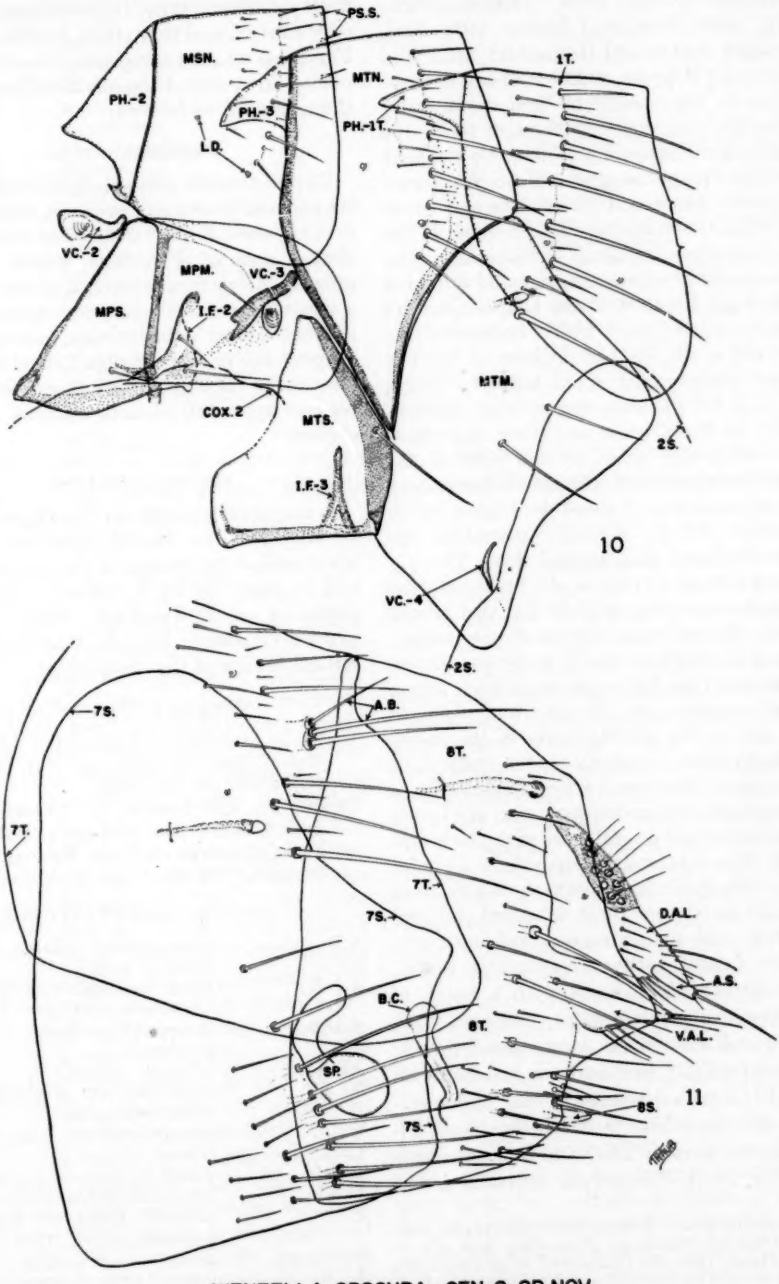
Aedeagal apodeme (Fig. 7, *AE.A*) about three and one-half times as long as broad; proximal spur and apical appendage absent. Median dorsal lobe (Fig. 8, *M.D.L.*) straight. Sclerotized inner tube (*S.I.T.*) fairly straight and unspecialized, its armature represented as a weakly sclerotized winglike expansion. Apicomedian sclerite (*A.M.S.*) on each side of *S.I.T.* consisting of two portions: a proximal short, caplike sclerite and a large apical weakly sclerotized, somewhat dumbbell-shaped structure. Lateral sclerotization of inner tube (*L.S.I.*) ill-defined. Crochet (*CR.*) consisting of a large troughlike sclerite extending well apicad of inner tube; dorsal margin slightly convex, parallel to ventral margin for most its length, but crochet subapically narrowing; ventral margin relatively heavily sclerotized. Lateral lobes (*L.L.*) narrow and extending to near apex of *S.I.T.*, apparently an undifferentiated portion of the semimembranous pouch wall (*P.W.*). Crescent sclerite (*C.S.*) well developed. Penis rods (*P.R.*) not fully coiled. Aedeagal apodemal rod (*A.A.R.*), the third penile rod, arising from the base of the almost invisible pouch wall. Vesicle (*V.*) fairly well developed. Apodemal strut (*AP.S.*) of usual type but sclerites not differentiated.

Tenth segment conspicuous; sensilium (Fig. 7, *SN.*) with about 12 pits per side. Dorsal anal lobe (*D.A.L.*) relatively well sclerotized, covered with bristles, those at apex long. Ventral anal lobe (*V.A.L.*) with long apical bristles, its outlines semimembranous for the most part. Proximal ventral sclerite of proctiger (*V.P.*) fairly well indicated.

Modified Abdominal Segments, Female (Fig. 11): Seventh sternum (*7S*) with caudal margin produced into a blunt lobe; below this, margin evenly convex; with four rows of bristles arranged approximately 4-8-9, those of last row very long. Seventh tergum (*7T.*) emarginate at level of the plate of the antesensiliary bristles, which are displaced slightly more ventrad. Eighth tergum (*8T.*) very large, with two irregular rows of long thin bristles ranging from above spiracle to ventral margin; with about four long additional submarginal bristles near ventral sinus; posterior margin markedly produced caudad at level of ventral anal lobe. Eighth sternum (*8S.*) vestigial. Dorsal anal lobe (*D.A.L.*) with about eight mediolateral bristles and a fringe of dorsal bristles; with a longer bristle at ventrocaudal angle. Ventral anal lobe (*V.A.L.*) not heavily sclerotized, ventral margin sinuate; with about three or four long thin bristles near anteroventral angle and one or two subapical bristles. Anal stylet (*A.S.* and Fig. 2) about three times as long as broad, with long apical bristle and two shorter subapical ones. Spermatheca (*SP.* and Fig. 3) with tail slightly longer than head, upturned. Head somewhat longer than broad; subpyriform. Bursa copulatrix (*B.C.*) fairly well developed, globose, its duct rather short.

DISCUSSION OF THE STATUS OF THE GENUS WENZELLA

As will be seen from the diagnosis, *Wenzella* differs greatly from other members of the subfamily (i.e., *Nearctopsylla* Rothschild, 1915, *Corypsylla* C. Fox, 1908, *Para-*



WENZELLA OBSCURA GEN. & SP. NOV.

FIG. 10.—Mesothorax and metathorax and first abdominal tergum, male.

FIG. 11.—Modified abdominal segments, female.

typhloceras Ewing, 1940, *Trichopsylloides* Ewing, 1938, *Stenischia* Jordan, 1932, *Rhadinopsylla* Jordan and Rothschild, 1912, and *Rectofrontia* Wagner, 1930[4]). Certain of these differences are shared by genera in other subfamilies and these are thought to be due to convergent evolution. Thus, the elongate maxillary palpi suggest *Megarthroglossus* (subfamily Anomiopsyllinae). The new genus resembles *Anomiopsyllus* Baker, 1904, in the loss of pronotal and genal ctenidia as well as in the marked reduction in size and numbers of the head bristles. These adaptations are characteristic of fleas which ordinarily are restricted to the nests of the host (1, 2). The caudad displacement of the tentorial bridge (Fig. 1, *T.BR.*) is also suggestive of *Anomiopsyllus*. In *Rectofrontia* and allies, as in most fleas, the bridge arises at the level of the anteroventral portion of the antennal groove.

In its possession of a well-developed fourth vinculum (*VC.4*), *Wenzella* resembles the neopsylline and pygiopsyllid fleas. The absence of a sinus to receive the first vinculum is also characteristic of these last two groups of fleas. Nevertheless, the taxonomic assignment of *Wenzella* is clearly indicated by the possession of the following characters: fusion of the segments of the antennal club; at least one of the internal rods of the meso- and metacoxae is cut short, interrupted or abbreviated; the large vertical internal furca of the mesosterna and metasterna; the fusion of the lateral metanotal area with the metanotum. The subfamily Neopsyllinae includes fleas which differ in important details from *Wenzella* as follows: male antennal club unmodified, and also extending well onto propleuron (along with corresponding fossa); inner surface of hindcoxa with a patch of spiniforms or small bristles; aedeagus with a very well developed, long, broad pouch; characteristically possessing a striarium on second abdominal segment. The Pygiopsyllidae are essentially Australasian fleas, although one genus is known to occur in South America. In this group the genitalia are of a very different type, the sensilium is markedly convex, and there is no frontal tubercle. For these reasons the genus *Wenzella* is best placed in a new tribe of Rhadinopsyllinae characterized as follows:

Wenzellini, n. tribe

Clypeal tubercle internal. Integrecipitate, but the antennal groove removed from crown of head in both sexes. First vinculum not received in a distinct sinus of prosternum. Fourth vinculum present. Metepimeral striarium absent. Lacking a striarium on second abdominal segment. Inner side of hindtarsi virtually nude, lacking a patch of spiniforms or short bristles. Lateral metanotal area absent, the huge metanotum extending down between upper half of metepisternum and metepimere.

[4] *Micropsylloides* Ewing, 1938, *Ralipsylla* Ioff, 1946, *Actenophthalmus* C. Fox, 1925, and *Micropsylla* Dunn, 1923, are considered to be synonyms of *Rectofrontia* and at best are subgenera. G. H. E. Hopkins, of the British Museum (Tring), has independently expressed a similar opinion about these genera of the Rhadinopsyllini.

ACKNOWLEDGMENTS

I am very grateful to Dr. Karl Jordan, F. R. S., of the British Museum (Tring), who verified the status of this unusual flea, and to Miss Phyllis T. Johnson, of the Department of Entomology, Army Medical Service Graduate School, Washington, for critical review of the manuscript.

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LIST OF ABBREVIATIONS

A.B.	antesensiliary bristle.
A.F.	antennal flange.
A.A.R.	third aedeagal rod (accessory apodemal rod).
A.M.S.	apicomedian sclerite.
A.S.	anal stylet.
AE.A.	aedeagal apodeme.
AP.S.	apodemal strut of aedeagus.
B.C.	bursa copulatrix.
C.S.	crescent sclerite.
CR.	crochet.
D.A.L.	dorsal anal lobe of proctiger.
D.A.9	distal arm of male ninth sternum.
F.	movable finger or digitoid of clasper.
GN.	gena.
I.F.2	internal furca of mesosternosome.
I.F.3	internal furca of metasternosome.
L.L.	lateral lobe of aedeagus.
L.P.	labial palpi.

L.S.I.	lateral sclerotization of inner tube.	PH.-1T.	phragma of first abdominal tergum.
LD.	lucodisc.	PS.S.	pseudosetae.
M.D.L.	median dorsal lobe of aedeagus.	S.I.T.	sclerotized inner tube of aedeagus.
M.P.	maxillary palpi.	SN.	sensilium.
MB.	manubrium.	SP.	spermatheca.
MPM.	mesepimere.	T.A.	anterior arm of tentorium.
MPS.	mesepisternum.	T.BR.	tentorial bridge.
MSN.	mesonotum.	TB.	frontoclypeal tubercle.
MTM.	metepimere.	V.	vesicle of aedeagus.
MTN.	metanotum.	V.A.L.	ventral anal lobe of proctiger.
MTS.	metepisternum.	V.P.	subanal sclerite.
MX.	maxillary lobe.	VC.1	first vinculum or link plate.
P.	immovable process of clasper.	VC.3	third vinculum or link plate.
P.A.9	proximal arm of male ninth sternum.	VC.4	fourth vinculum or link plate.
P.R.	penis rod.	7S.	seventh sternum.
P.W.	wall of aedeagal pouch.	7T.	seventh tergum.
PH.2	phragma of mesonotum.	8S.	eighth sternum.
PH.3	phragma of metanotum.	8T.	eighth tergum.

ORNITHOLOGY.—*A taxonomic study of the American dunlin* (Erolia alpina *subspp.*). W. E. CLYDE TODD, Carnegie Museum, Pittsburgh, Pa. (Communicated by Herbert Friedmann.)

The red-backed sandpiper, or dunlin, like certain of its affines, is circumboreal and Holarctic in its breeding range; unlike many of them, however, it does not retire into the Southern Hemisphere for the winter, but spends that season in more temperate climes. A common and well-known shorebird, it received its specific name *alpina* from Linnaeus in 1758. Obviously, it must have been one of the species he himself observed on his trip to Lapland in 1752, since he quotes no other authority. In 1766, however, failing to identify his bird with Brisson's "l'Alouette de Mer," he redescribed the latter as *Tringa cinclus*. Meyer and Wolf's *Tringa variabilis* (1810) made a third designation for the same species, and the vast majority of the Old World references, as listed by Sharpe (1896), Ridgway (1919), and others fall under one or the other of these three names. In view of the seasonal changes to which the species is subject, and which were imperfectly understood in those early days, considerable allowance must be made for this duplication. It was some years before these supposed species were recognized as identical and the later names discarded. In the meantime two additional forms of the group had been described: *Tringa schinzii* by C. L. Brehm (1822) from the shores of the Baltic Sea and *Scolopax sakhalina* by Vieillot (1816) from Sakhalin Island, but the latter was not recognized as pertinent until Buturlin (Auk **21:** 53. 1904) called attention to it. The form *schinzii*, although accepted by many authorities, was discounted by Sharpe (1896), who rightly considered it merely a geographical variant. From the material examined in this connection (11 specimens from Holland and Sweden) it appears to be an easily recognizable race, characterized by its smaller size and heavier breast-streaking as compared with true *alpina*. It breeds in the British Islands and in corresponding latitutdes in Holland and the Baltic Sea countries—far to the southward of the normal range of true *alpina*.

In due course the known range of the species was extended by various American authors, beginning with Wilson in 1813. No distinctions were admitted between the European and American birds until 1858, when Cassin drew attention to the larger size and disproportionately longer bill of the latter, which he thereupon christened *americana*, but without designating a type specimen. The name was accepted by most American writers, although latterly only in a subspecific sense. A few years later (1861) Coues discussed a supposedly larger race from the Pacific coast, which he provisionally

named *pacifica*. In 1885 Stejneger pointed out that Cassin's name *americana* was preoccupied, and proposed to replace it by Coues's *pacifica*. He claimed that Coues's type (here designated as no. 9540, collection U. S. National Museum) was "in every essential a true *P. americana* CASSIN," which form was common to "both the Asiatic and American shores of the Pacific Ocean." Stejneger's conclusions were adopted in the American Ornithologists' Union Check-List and were indeed not questioned until 1904, when the Russian ornithologist Buturlin showed that Vieillot's long unrecognized name *Scolopax sakhalina* (1816), from Sakhalin Island, was pertinent to the Pacific form. As a result this name came into general use, nor was it ever challenged until 1914, when Thayer and Bangs insisted that east Siberian birds were not the same as American birds, to which latter they restored the name *pacifica*. The latest authors to discuss the question (Hellmayr and Conover, 1945) fully indorse and emphasize Thayer and Bangs's views. And thus the matter stands at present.

The identification of dunlin specimens he collected in Alaska gave some trouble to A. M. Bailey (Condor **28:** 34. 1926) and to the authorities to whom he sent them for determination. He has generously placed his entire Alaskan series at my disposal. Taking breeding birds alone, I find that there seem to be two forms represented. One of these is a comparatively short-billed bird, with the dusky streaking on the throat and breast subdued or nearly wanting. Of this form there are available 26 breeding specimens from Point Barrow, Wainwright, Chipp River, and Point Hope—all in northern Alaska. The other form, represented by 20 breeding specimens from the rest of Alaska, is longer-billed by comparison, with heavier streaking on the throat and breast. Young birds of the two races in the spotted juvenal dress appear to differ only in the length of the bill.

Through the courtesy of certain other institutions I have been able to compare a fair series of dunlin specimens from Sakhalin Island—topotypes of *sakhalina* of Vieillot—with the northern Alaska series, and I find the two populations racially distinct. As Conover says, the upperparts in Sakhalin birds average lighter-colored—more buffy, less rufescent. Also the black area of the underparts averages more restricted. Compared with *pacifica* the much longer bill, darker upperparts, and more heavily streaked breast of the latter will serve to distinguish breeding specimens of the two forms at a glance. Note that Conover's study did not involve examination of any specimens taken north of Nome; this will account for his failure to discriminate a northern race. As already stated, I have seen no specimens of this race from south of its breeding grounds, but I believe that the relatively shorter bill would serve to distinguish them.

Now we come to consider the dunlin population of the American Arctic east of Alaska. Fortunately we have a fine series of breeding birds from two localities, Churchill on the west coast of Hudson Bay and Southampton Island at its northern end. Even a casual comparison of these with breeding Alaskan birds will show that we are here dealing with a different race. Seasonally comparable Hudson Bay birds are obviously lighter brown above than Alaskan *pacifica*—raw sienna as against antique brown—although the streaking on the throat and breast runs about the same, and their bills average a trifle shorter. Birds taken in spring migration (May) show the same color differences when compared in series, although less markedly. Owing to lack of material I am unable adequately to compare birds in the ventrally spotted juvenal dress, but those I have seen (from Southampton and Churchill) vary greatly in the amount of spotting, while the different stages of postjuvenal molt cause great variation in the color of the upperparts. Judged from the description and measurements in Salomonsen's *Birds of Greenland*, these cannot be referred to *arctica*, since their bills are much too long. This Hudson Bay population is also sufficiently homogeneous and well marked to deserve racial recognition. In North America we should then have three races of the dunlin regularly represented, as follows:

Erolia alpina arcticola, n. subsp.

Type.—No. 8503, collection Carnegie Museum,

adult male; Point Barrow, Alaska, June 8, 1898; E. A. McIlhenny.

Subspecific characters.—Similar to *Erolia alpina pacifica* (Coues) of middle and southern Alaska, etc., but bill averaging somewhat shorter (sex for sex); and throat and breast more lightly streaked (sometimes nearly immaculate). Similar also to *E. alpina sakhalina* (Vieillot) of Sakhalin Island and eastern Asia in general, but upperparts darker colored; throat and breast more decidedly streaked; and black abdominal area averaging more extensive.

Measurements.—Adult males in breeding dress: Wing, 113–122 (average, 116.6); bill, 33–35 (33.7); tarsus, 22.5–25 (23.6). Female (8 specimens): Wing, 114–124 (120.5); bill, 34–39.5 (37); tarsus, 24–26 (25).

List of specimens.—Alaska: Point Barrow, 18; Point Hope, 1; Chipp River, 2; Wainwright, 25. Total, 46.

Range.—Northern Alaska in summer; migratory and winter ranges not yet ascertained.

Erolia alpina pacifica (Coues)

[*Pelidna*] *Pacifica* Coues, Proc. Acad. Nat. Sci. Philadelphia, July 1861: 189 (west coast of North America; the type from Simiahmoo, Washington —*cf.* Stejneger, U. S. Nat. Mus. Bull. 29: 121. 1885).

Remarks.—The most distinctive character of this race is its relatively longer bill, which serves to distinguish it in winter dress when the plumage characters are obscured. In breeding plumage it tends to run a little darker above than *arcticola*, while the throat and breast average more heavily streaked. There are available a good series of breeding birds of this race from Wales, Alaska, also some typical specimens from St. Lawrence Island, Bering Sea, and winter and spring birds from the coast farther south. *E. a. pacifica* is of course very different from *sakhalina*, as Conover truly says. His comparisons of the two, be it noted, were made with specimens of undoubted *pacifica* and not of the more northern *arcticola*. There is no evidence that *pacifica* migrates southward along the Siberian coast, although it may do so upon occasion. All the specimens seen from that region appear referable to *sakhalina*, as defined by Conover.

Measurements.—Adult males in breeding dress: Wing, 110–121 (average, 115.5); bill, 35–43 (37.4); tarsus, 22–26.5 (24.7). Female: Wing, 109–120 (118.3); bill, 38–43.5 (41.4); tarsus, 24–27 (25.7).

List of specimens.—Alaska: Wales, 14; Cape Prince of Wales, 2; St. Lawrence Island, Bering Sea, 4. British Colombia: Denman Island, 1. Washington: Simiahmoo (type), 1. Oregon: Bayocean, 3; Newport, 2; Devils Lake, 1; Netarts Bay, 2. California: Mount Eden Landing, 1; San Diego, 8. Lower California: Abreojos Point, 3. Total, 42.

Erolia alpina hudsonia, n. subsp.

Type.—No. 110079, collection Carnegie Museum, adult female; Coral Inlet, Southampton Island, Hudson Bay, Canada, June 6, 1930; George M. Sutton.

Subspecific characters.—Similar in general to *Erolia alpina pacifica* (Coues) of central and southern Alaska and the Pacific coast of America, but general coloration of upperparts richer and brighter; throat and breast more heavily streaked with dusky; and bill averaging slightly shorter.

Range.—From the Mackenzie Delta (presumably) east along the Arctic coast and islands to Baffin Land, and south along Hudson Bay to Churchill; migrating through eastern Canada and the eastern United States to the Gulf coast.

Measurements.—Adult males in breeding plumage: Wing, 113–118 (average, 115.5); bill, 35–38.5 (36); tarsus, 25–27 (25.4). Female: Wing, 114–120 (117); bill, 37–41 (39); tarsus, 25–28 (26.3).

Remarks.—Comparison of our fine series of breeding birds from Hudson Bay and northward shows that they represent a race different from either of the Alaska birds. The brighter coloration of the upperparts and the more heavily streaked throat and breast are constant features when specimens in the same stage of plumage are compared. In winter dress this race may sometimes be distinguished from *pacifica* by the tendency to a shorter bill, but there is so much overlap in this respect that the distinction is far from absolute. It is fair to presume, however, that this is the race that migrates across eastern North America to its winter quarters on the Gulf coast.

List of breeding specimens.—Southampton Island, Hudson Bay: Coral Inlet, 11; Four Rivers, 4; Prairie Point, 4; Fords Brooks, 3. Manitoba: Churchill, 15. Total, 37.

There remain several North American dunlin records which have been referred to true *alpina*, but which according to Hellmayr and Conover (Publ. Field Mus. Nat. Hist., zool. ser., **13** (pt. 1, no. 3); 200, note. 1948) more likely pertain to the Greenland race, *arctica*. In view of the dis-

tinctions noted in the present paper, re-examination of these records is indicated.

The writer wishes to thank the institutions that have courteously placed at his disposal their material representing this group: Denver Museum of Natural History (A. M. Bailey); Academy of Natural Sciences of Philadelphia (Rodolphe M. de Schauensee); Museum of Comparative Zoology (J. C. Greenway, Jr.); and United States National Museum (Dr. Herbert Friedmann).

Measurements are based on a series of 10 specimens (unless otherwise specified).

ZOOLOGY.—Postmonorchis donacis, *a new species of monorchid trematode from the Pacific coast, and its life history.* R. T. YOUNG,[1] University of Montana (emeritus). (Communicated by E. W. Price.)

Hopkins (1941) has described a monorchid trematode in the pigfish (*Orthopristis chrysoptera*) and the spot (*Leiostomus xanthurus*), and Manter (1942) and Hanson (1950) have found the same worm in the grunt (*Haemulon flavolineatum*) although the latter writer questions the identity of the fish which she studied. A trematode of the same genus but a new species has been found by me in several species of surf perches (Embiotocidae), the corvina (*Menticirrhus undulatus*), and spot fin croaker (*Roncador stearnsi*) which I now propose to describe, together with a note on its life history.

The worms were studied mainly in the living condition, but whole mounts fixed in the Dubosq-Brazil modification of Bouin's fluid and in an alcoholic solution of mercuric chloride with a 5-percent addition of acetic acid and stained in acetocarmine and in Ehrlich's hematoxylin have also been employed.

The trematodes were numerous in 1935–36 and again in 1951. No search was made for them in the interim, but the infrequence of their intermediate host, the bean clam (*Donax gouldii*), during this period renders their occurrence then unlikely.

They differ from *P. orthopristis* as follows: Their form is different, being slender rather than rounded and resembling *Genolopa* in this respect. The testis is longer than wide, while the reverse is true in the former, and the posterior notch mentioned by Hopkins is lacking. The vitelline reservoir is inconstant, depending on the state of contraction or expansion of the yolk ducts. The excretory bladder is approximately spherical rather than elongated, while the uterus fills almost the entire posterior body region instead of being restricted mainly to the lateral regions. Black pigment spots are present, either as consolidated "eye" spots or as scattered granules evidently the remains of definite "eye" spots in the larva. The flame cell pattern could not be completely determined. In most specimens the flames were inactive, and in spite of a careful examination several probable cells escaped detection. All that could be seen are shown in Fig. 1. Judged from the close relationship of this worm to *P. orthopristis* it is highly probable if not absolutely certain that the formula is the same as that given by Hopkins for the latter.

Postmonorchis donacis, n. sp.

Slender, elongated worms covered with small spines anteriorly, which gradually disappear near the ventral sucker. Dimensions of fresh specimens, flattened beneath a cover glass: length 0.48 mm; width, 0.207; oral sucker, 0.071; ventral sucker, 0.06; pharynx, 0.048 by 0.031; ovary, 0.037 by 0.031; testis, 0.055 by 0.052; seminal vesicle, 0.105 by 0.095; eggs 0.024 by 0.015. In fixed material the dimensions are as follows: length, 0.336 mm; width 0.07; oral sucker, 0.046; ventral sucker, 0.038; seminal vesicle, 0.059 by 0.0345; ovary, 0.042 by 0.028; testis, 0.047 by 0.033; eggs, 0.021 by 0.012. Pigment spots present. Ventral sucker at about one-third length of body from anterior end. Ceca terminate posterior to anterior end of testis. Vas deferens and metraterm open through a gonopore in the midline just anterior to the ventral sucker. The cirrus sack

[1] I am indebted to Dr. Carl L. Hubbs, of the Scripps Institution of Oceanography, for the use of an aquarium in the prosecution of this research, and to the San Diego Zoological Society and the U. S. Bureau of Animal Industry for the occupation of rooms in their laboratories. I also had the privilege of spending a few days at the laboratory of the U. S. Fish and Wildlife Service at Beaufort, N. C. To all these my thanks are due. I am indebted too to Edward W. Johnson, of the University of Maryland, for the preparation of the map.

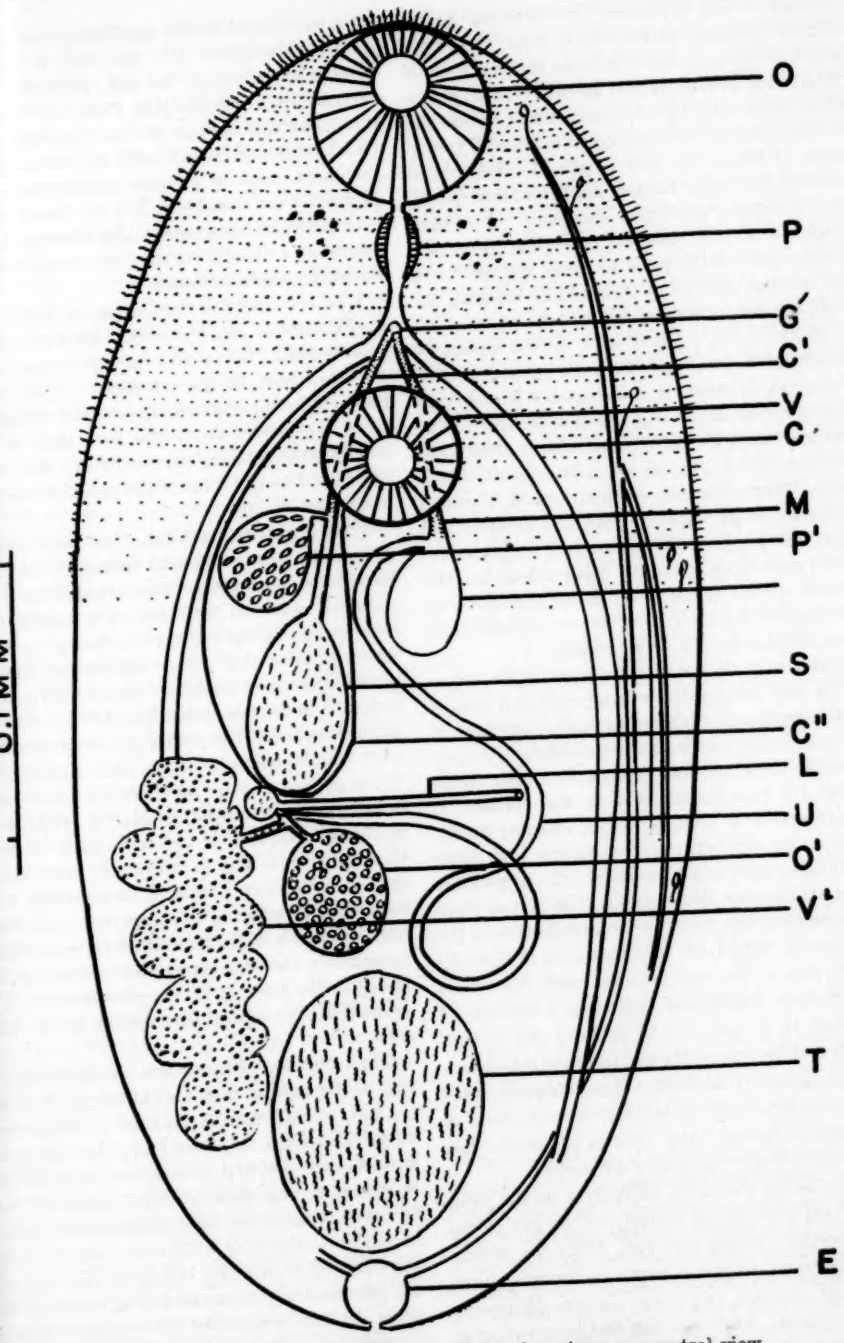

FIG 1.—Free-hand drawing of *Postmonorchis donacis*, n. sp., ventral view.

encloses a heavily spined vas deferens and a distinct prostate gland which joins the latter where it expands into the large seminal vesicle. Metraterm heavily spined anteriorly with a posterior blind sack. Gravid uterus filling almost the entire posterior body and opening into the metraterm at about its mid length. Laurer's canal present. Excretory bladder approximately spherical. Vitellaria dendritic, composed of several lobes on a side, usually extending from the anterior end of the testis to about the middle of the seminal vesicle but occasionally reaching beyond the ventral sucker.

Manter (*l.c.*, p. 350) says of the excretory vesicle in monorchids, "In some genera . . . it is Y-shaped, in others it is I-shaped." No mention of a spherical shape is given. And further, "The seminal vesicle in the Monorchidae is often rudimentary and if present at all is difficult to observe." Regarding the seminal vesicle Manter's statement is at variance with the account and figure (8) given by Hopkins (*l.c.*) for *P. orthopristis* and with my own observations on the present species, while in the latter the excretory bladder differs widely from the accounts of both these authors for the Monorchidae.

Location of the parasite in the gut of the fish.—In the surf perches the worms are found mainly in the rectum though occasionally elsewhere in the gut; in the corvina their distribution is more general. Three possible explanations offer themselves for this distribution in the former: 1, Easier access to oxygen in the rectum; 2, differences in pH between the rectum and other parts of the gut; and 3, chemical differences other than pH between these regions. The first of these is apparently ruled out by the distribution in the corvina. A test of pH in a specimen of *Cymatogaster*, one of the surf perches, made for me at the Scripps Institution showed a difference of one-half to 1 unit of pH between the rectum (5.92) and the rest of the gut from the duodenum to the rectum (6.45–6.90). This difference, however, is not peculiar to the surf perches, tests of the gut of several other species of marine fish made by me showing similar differences.

This leaves the third alternative as the most likely explanation. In a study of the gut of the surf perches (Young and Fox, 1936) the rectum was found to contain a brown or orange-colored pigment derived from the shrimp (*Hippolyte californiensis*), which the fish had been eating at the time. Dr. Fox determined this pigment to be a carotenoid of the xanthophyll series which occurs throughout the gut but is transitory throughout most of the gut, persisting in the rectum for a considerable time, but ultimately disappearing there also when a xanthophyll rich diet is withheld. Apparently the worms find attachment easier in a region which is rich in this pigment than elsewhere. It is not essential however for their attachment and survival as their distribution in the corvina, and occasionally in the surf perches indicates.

In this connection the findings of Nicoll (1913, p. 200) are of much interest. He found *Zoonogenus viridis* "universally in the rectum and in no other part of the intestine . . ." of the sea bream (*Sparus centrodontus*). "The rectal contents . . ., partly from the fact that it feeds largely on Crustacea, are usually of a dull brownish color, but the color of the parasite was much more intensely red."

This similarity in location of two different trematodes in two different species of fish would seem to be more than a mere coincidence.

Larval stages in the clam.—The larvae in the clam occur as sporocysts producing cercariae, which in turn give rise to metaceriae. The size of the sporocysts naturally varies with age, the largest I have seen measuring 0.72 by 0.14 mm in fixed material. The young sporocysts are somewhat motile, changing shape from time to time. When present in large numbers the visceral mass is extensively destroyed, as Martin (1940) found in *Cummingia*, and is yellow in color. The fact that the clam is almost universally infested with metacercariae (see p. 92) in considerable numbers without suffering any apparent harm therefrom renders it likely that either (1) several light infestations succeed one another without serious injury to the host, or (2) the visceral mass is regenerated after partial destruction by the parasite.

The cercaria.—The cercaria is illustrated in Fig. 2. It measures 0.43 mm in length, including the tail, by 0.08 mm in diameter in living specimens. The tail is 0.17 mm long, the oral sucker is 0.045 mm and the ventral sucker 0.039 mm in diameter, the pharynx 0.017 by 0.011 mm. In fixed material the dimensions are as follows: length (including tail) 0.228 mm, diameter 0.042, tail 0.09. There are two eye spots. The anterior half of the body is covered with small spines, while the tail is encircled by numerous rings of overlapping scales which give the appearance of spines.

I could not determine all details of the excretory system. There is a small globular bladder at the base of the tail, with a group of several gland cells anterior to it containing granules which stain in neutral red. From the bladder two excretory ducts extend forward to the region of the oral sucker.

Posterior to the ventral sucker the anlage of the future reproductive organs can be seen.

This cercaria resembles closely *Cercaria myocerca* of Villot (1878) except for a slight difference in the relative length of tail and body. It also resembles *Cercaria cummingiae* of Martin (*l.c.*). Both of these larvae, as well as the present one, infest marine pelecypods, so that in habit as well as structure they appear to be identical. Regarding the latter larva Martin (p. 473) says: "The cercaria has certain characters in common with *Cercaria myocerca*, Villot . . . Both of these larvae have the simple, sac-shaped type of excretory bladder. This seems rather significant since *C. myocerca* is a marine form with a setiferous tail and all other described species of setiferous-tailed marine cercariae have either a Y or U-shaped, or a long tubular excretory bladder. Both species have eye spots. The molluscan host of *C. myocerca* is *Scrobicularia tenuis* which belongs to the same family as *Cummingia*." I regard the present species as identical with *C. cummingiae* which is, to all appearances synonymous with *C. myocerca*.[2]

Regarding the adult worm to which these larvae belong Villot (*l.c.*) considered it to be an amphistome, which, as Dollfus (1925) says, is highly improbable. Martin on the other hand thought it was one of the Allocreadiidae. As will be seen from what follows it is highly probable that the adult worm is a monorchid.

The metacercaria.—The metacercaria can be rather easily excysted by pressure on the cover glass. When removed from the cyst it measures, extended, between 0.3 and 0.4 mm. It is located mainly at the base of the siphons, but occurs also in the gills and the edge of the mantle.

The life history.—It has not been possible to work this out completely. I have shown, as will be seen shortly, that the clam *Donax gouldii* is an intermediate host. But whether this is the only one is uncertain. I have made repeated attempts to infest the clam with eggs from the adult worm but all of them were failures. Many worms containing brown-shelled eggs were teased and put in small vials or beakers with the clams, but no miracidia emerged, nor were sporocysts or cercariae found in the clams so exposed, even when the eggs contained active embryos. Most of these experiments were performed in sea water, but in one, Ringer's solution plus mucous from the gut of an *Embiotoca* was used and in others extracts of the gut of a corvina and an *Embiotoca* were employed. I have also made a few attempts to infest the clams by pipetting eggs between the valves of the shell of four *Donax* but without success.

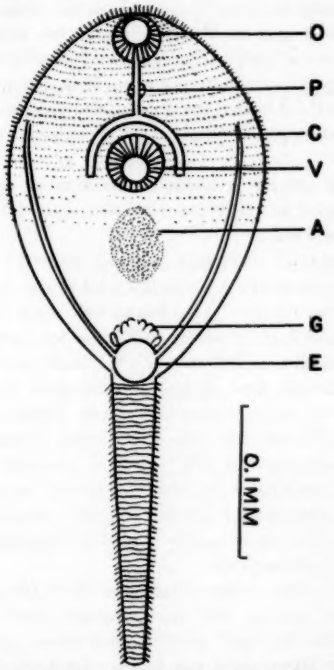

FIG. 2.—Free-hand drawing of the cercaria of *Postmonorchis donacis*, n. sp.

Martin (*l.c.*) has described the life cycle of a related species, *Monorcheides cummingiae*, in the clam, *Cummingia tellinoides* and eels and flounders. He demonstrated the transfer of the parasite from the clam to the fish and postulated its passage in the reverse direction. He also demonstrated the transfer of cercariae from an infested to an uninfested clam, but did not determine

[2] Should subsequent experiments prove conclusively that *Cercaria donacis* is identical with *C. myocerca* the specific name *donacis* will be superseded by *myocerca*, which has priority. Until such demonstration, however, I prefer to use the new name, *donacis*.

their mode of entrance into the latter, whether through the mouth or the body surface. I have placed active cercariae in dishes with clams but failed to infest the latter. And the cercariae are not attracted by siphons of the clam nor have I seen any of them ingested.

I have, however, found a few cercariae in the clam which lacked tails and were surrounded by a very thin cyst, evidently the first stage of the metacercaria. I have also observed a second stage, intermediate in size between the first and the final stage, which latter is identical with the young worm.

It seems certain that eggs teased out of the worms are not infective. It may be that they require a period of ripening in sea water before becoming so. Martin (*l.c.*), however, found that exposing eggs of *Monorcheides* to sea water for three weeks failed to induce development so that this hypothesis is improbable. It is also possible that a third host is involved in the cycle, perhaps a small copepod which may be ingested by the clam.

The reverse transfer, from clam to fish has succeeded in many experiments, as the following data will show.

A gravid *Embiotoca jacksoni* spawned in an aquarium at the Scripps Institution several days after its capture. The young fish were divided into two lots of seven each, one lot being fed abundantly on *Donax* while the other lot served as controls. One of the experimental fish was found on examination to contain *Postmonorchis* while the controls were all negative. Another of the experimental fish was also infested with small trematodes but the condition of the worms when examined rendered positive identification impossible. It is highly probable that they too were *Postmonorchis*.

Of seven other *Embiotoca* fed *Donax* six proved positive for the parasite, while of 17 controls 14 were negative and three positive. Of 13 *Micrometris* fed *Donax*, 12 proved positive and one negative, while of 44 controls 43 were negative and one positive. In Mission Bay, an arm of the sea near San Diego, *Cymatogaster* breeds abundantly in April and May in the kelp and eel grass which line its shores. There are no *Donax* in the bay and the young perch are apparently never infested. Feeding *Donax* to 24 of these young fishes resulted in infesting 16, while 16 control fish were all negative. That all the experimental fish in these experiments

FIG. 3.—Map of the San Diego region, Calif.

received metacercariae is rendered virtually certain by the fact that of 400 clams examined only five lacked these organisms.

I have calculated the significance of these results by a formula in Tippett (1937)

$$T = \frac{X - X'}{S\sqrt{1/N + 1/N'}} \text{ and } S^2 = \frac{\Sigma(x - X)^2 + \Sigma(x' - X')^2}{N - 1 + N' - 1}$$

where X and X' represent the averages of the experimental and the control observations, x and x' the value of each experimental and control observation respectively, and N and N' the number of these observations. Knowing the value of T and the number of observations, both experimental and control, the probability of the result, based solely on chance, can be determined from a table compiled by Dr. George F. McEwen of the Scripps Institution of Oceanography.[3] Applying this formula to the first of the above experiments it becomes $T = (.143 - 0)/S\sqrt{.2857} = 1.1$, where $S = \sqrt{(1 - .143)/12} = .25$, which gives a probability of .1465. That is, there is about one chance in seven that this result might be due to chance alone. Including both of the infested experimental fish in the calculation, which is reasonably justified, the probability becomes 0.044, or about 1 in 25. Making a similar calcula-

[3] This table is based on one in Fisher's *Statistical methods for research workers* but is more comprehensive.

tion for the other experiments recorded above the probabilities in none of them exceed 1 in 1,000.

The percentage of infested fish from different regions is also significant. *Donax* occurs only on the beaches where it is subjected to wave action and is alternately submerged and exposed by the tides. In both Mission and San Diego Bays (see map) tidal action occurs but wave action is absent, as is *Donax*, while on the beach at La Jolla it is present in vast numbers in certain years. Both of the bays connect with the sea through narrow channels which may serve to isolate their fish from the open sea, at least for considerable periods. Unfortunately I have inadequate data for the same species of fish, but a comparison of different species, all of which serve as hosts for the parasite is of much interest. In 1935 of 26 *Embiotoca* taken at La Jolla all but three were infested, several of them heavily, while of 33 *Micrometris* and 64 *Cymatogaster* from San Diego Bay only one of the former and none of the latter were infested. Many corvina were also taken at La Jolla in this year all but one of which were infested. It is obvious from these results that fish which have access to *Donax* are extensively infested, while those deprived of it seldom are.

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ABBREVIATIONS USED ON FIGURES

A, reproductive anlage.
C, caecum.
C′, cirrus.
C″, cirrus pouch.
E, excretory bladder.
G, glands.
G′, gonopore.
L, Laurer's canal.
M, metraterm.
O, oral sucker.
O′, ovary.
P, pharynx.
P′, prostate.
S, seminal vesicle.
T, testis.
U, uterus.
V, ventral sucker.
V′, vitellarium.

PROCEEDINGS OF THE ACADEMY

458TH MEETING OF BOARD OF MANAGERS

The 458th meeting of the Board of Managers, held in the library of the Cosmos Club on November 17, 1952, was called to order by President RAMBERG at 8:03 p.m. with the following in attendance: WALTER RAMBERG, H. S. RAPPLEYE, J. A. STEVENSON, W. F. FOSHAG, A. T. MCPHERSON, W. R. WEDEL, SARA E. BRANHAM, W. W. DIEHL, F. M. DEFANDORF, FRANK M. SETZLER, A. G. MCNISH, L. A. SPINDLER, HERBERT G. DORSEY, MARTIN A. MASON, E. H. WALKER, W. N. FENTON, J. R. SWALLEN, and J. P. E. MORRISON.

The President announced the appointments of W. T. READ and N. L. DRAKE to the Science Education Committee.

It was recommended that the Committee on Policy and Planning together with the Executive Committee consider publishing a simplified Red Book, and that it list the Members of the Academy, the Constitution and the Bylaws, and information pertaining to the objectives of the Academy, and that a page be devoted to each of the Affiliated Societies. The hope was expressed that this material can be published early next year.

Chairman MCPHERSON, of the Committee for the Encouragement of Science Talent, presented

a report that listed 45 members of professional societies who are now cooperating in the Promotion of Science Talent. This group has been organized to provide effective contact with students through assembly programs in all local private and public junior and senior high schools, at which an engineer or scientist will speak. They will also provide for group conferences with students in cooperation with science supervisors and school principals.

Messrs. McPHERSON and McNISH spoke of the Christmas Lectures to be sponsored by the Philosophical Society for the Washington Junior Academy of Science. The first lecture is scheduled for December 30 on which date Dr. LAND, of the Polaroid Corporation, will speak.

The President read the following report of the Nominating Committee:

The Nominating Committee, consisting of the Vice-Presidents of the Academy, met at the Cosmos Club on Monday, October 27, 1952. The meeting was called to order at 8-15 p.m. by A. G. McNISH, who presided. Others present were: HERBERT G. DORSEY, JOHN K. TAYLOR, JOHN A. STEVENSON for LEE M. HUTCHINS, and ARNOLD H. SCOTT.

The nominees selected for the offices to be filled by balloting by members in December were as follows: For President-Elect, FRANCIS M. DEFANDORF; for Secretary, JASON R. SWALLEN; for Treasurer, HOWARD S. RAPPLEYE; and for the Board of Managers to serve from January 1953 to January 1956 (two to be elected), MARTIN A. MASON, RAYMOND J. SEEGER, WILLIAM T. READ, and HERBERT G. DORSEY.

The death on October 13, 1952, of Dr. PAUL G. NEAL, Director of the U. S. Public Health, was announced.

Senior Editor FOSHAG reported conversations subsequent to the last meeting with F. N. FRENKIEL who thought that four to six articles in mathematics and physics would have to be published in each number of the JOURNAL to build up sufficient interest in the JOURNAL in these fields. Dr. Foshag felt that this would require a large increase in the budget. President RAMBERG suggested everything possible be done to maintain and broaden general reading interest and suggested that it might prove attractive to readers if a section were devoted to prompt publication of brief notices of new developments in these fields. The meeting adjourned at 9:55 p.m.

459TH MEETING OF BOARD OF MANAGERS

The 459th meeting of the Board of Managers held in Room 304 of the Cosmos Club on December 15, 1952, was called to order by President RAMBERG at 8:03 p.m. with the following in attendance: WALTER RAMBERG, F. M. DEFANDORF, H. S. RAPPLEYE, J. A. STEVENSON, FRANK M. SETZLER, C. F. W. MUESEBECK, SARA E. BRANHAM, R. G. BATES, HUGH T. O'NEILL, JOHN K. TAYLOR, W. A. DAYTON, A. H. SCOTT, L. A. SPINDLER, M. A. MASON, E. H. WALKER, H. W. WELLS, W. N. FENTON, and, by special invitation, J. R. SWALLEN, L. E. YOCUM, ROBERT G. DUNCAN, and LAWRENCE A. WOOD.

The Secretary read the following report for the Executive Committee:

Meeting of the Executive Committee December 12, 1952, attended by Messrs. Dayton, Ramberg, Rappleye, Setzler, and Defandorf. Mr. Dayton, Chairman of the Policy and Planning Committee, reported on the recommendation that his committee offered in answer to the question raised at the May meeting of the Board as to what material newly elected members should receive from the Academy. There was general agreement that newly elected members should receive in addition to the usual letter telling of election and the monthly copies of the Journal, a certificate of membership, a copy of the Academy Bylaws, information on the history and aims of the Academy, information on the Affiliated Societies, and a current listing of Academy members.

After a discussion of detail the Executive Committee was of the opinion that in future Red Books the Academy should list Academy members but should not attempt to include the names of members of its Affiliated Societies. It was felt that in terms of the 50th anniversary issue, the current 1947-48 Red Book now out of print, the next issue could well be reduced in complexity and size.

In brief it was felt that in the future Red Books should contain the following minimum information:

1. A brief history of the Academy.
2. Paragraphs describing how the objectives of the Academy are being met.
3. The Academy Bylaws and Standing Rules of the Board of Managers.
4. Descriptive material on the Affiliated Societies including a current listing of their officers.
5. List of Academy members with addresses, and separate groupings of members in accordance with employment connections.
6. Listing of usual meeting-times-and-places of the Affiliated Societies.

A preliminary draft of material for (2) above was presented and it was understood that the Secretary and Treasurer will assemble the other information needed for publication.

It was understood that the Treasurer will obtain estimates as to the cost of printing the Red Book by letterpress and a similar estimate for photo-offset reproduction, looking forward to possible annual publication of the Red Book in the

above simplified form, an edition to be published early next year.

The Executive Committee considers that separate certificates of membership should be issued to each new member and to those active members who did not receive certificates after they were discontinued.

The Executive Committee is hopeful that suitably inexpensive editions of the Red Book and desirable but less expensive membership certificates can be prepared so that they may be retained as annual budget items. Methods of preparation of certificates were discussed and will be investigated as to cost. The treasurer will include these as appropriate items in next year's budget.

There was a discussion of a letter from the National Science Foundation. The Foundation is not in a position to assist financially in the publication of the Index. It was felt that the Academy should proceed without delay to publish the Index. The Committee on Monographs should prepare plans for widely circulating the announcement of publication of the Index, as this should prove helpful in recovering a fair proportion of the total cost through greater purchases by libraries and other nonsubscribers to the JOURNAL.

This report was approved.

Chairman WELLS of the Committee on Meetings mentioned that the following meeting on January 15 was scheduled as the Annual Dinner Meeting of the Academy. It was decided to leave all arrangements in the hands of the Meetings Committee.

Chairman FENTON of the Committee on Monographs reported that he had been in touch with Mr. OEHSER and that the galley proof of the Index has been received. It appears that on a double-column basis the Index will run about 330 to 400 pages.

JASON R. SWALLEN, Chairman of the Committee on Awards for Scientific Achievement, asked the Chairmen of his subcommittees who had been invited to attend this meeting to present nominations for the awards.

Chairman YOCUM of the Grants-in-Aid Committee presented a report filed with the Secretary that recommended a grant of $200 for the purchase of radioactive sodium from the Atomic Energy Commission to EDWARD HACSKAYLO for a mycorrhizal research to be carried out at the Institute of Physiological Research in Uppsala, Sweden, under Dr. Elias Melin, a world authority on this subject. This research will be made in completion of requirements for a Ph.D. degree at George Washington University.

Mr. DAYTON, Chairman of the Policy and Planning Committee, presented a report for his Committee which was filed with the Secretary. It included in addition to the items reported above as being adopted at the meeting of the Executive Committee the following paragraph:

With regard to finances: There is general agreement among the Committee members that the Academy's finances should be sound and that we should keep out of debt; that our annual income (about 90 percent) should be spent only for definite objectives—such as the JOURNAL, the Junior Academy, appropriate meetings and conferences, and the stimulation and advancement of science in our area—with perhaps 10 percent held as a reserve for contingencies. Majority sentiment is that permanent headquarters with a paid full-time executive secretary is "very far in the future" and should not be considered unless and until justified by the amount of business and income of the Academy.

There was a discussion of the possibility of a paid secretarial arrangement by Messrs. WELLS, DAYTON, and RAPPLEYE that confirmed the conclusion of this Committee.

For the Committee on the Encouragement of Science Talent President RAMBERG reported for A. T. MCPHERSON that the announcements of the Christmas Lecture of the Philosophical Society of Washington were being sent to all members of the Washington Junior Academy of Sciences. He reported that up till then a total of $510 had been received from Affiliated and several other Societies in support of the District of Columbia Annual Science Fair.

The Secretary reported the death of Dr. EDWIN F. WENDT on September 30 and of Dr. CHARLES L. G. ANDERSON on December 10, 1952.

The meeting adjourned at 10:00 p.m.

460TH MEETING OF BOARD OF MANAGERS

The 460th meeting of the Board of Managers held in Room 304 of the Cosmos Club on January 12, 1953, was called to order by President RAMBERG at 8:02 p.m. with the following in attendance: WALTER RAMBERG, F. M. SETZLER, F. M. DEFANDORF, H. S. RAPPLEYE, J. A. STEVENSON, W. F. FOSHAG, A. T. MCPHERSON, F. W. HOUGH, H. G. DORSEY, SARA E. BRANHAM, W. W. DIEHL, A. G. MCNISH, F. W. POOS, A. H. SCOTT, R. S. DILL, L. A. SPINDLER, and, by invitation, E. H. WALKER, H. W. WELLS, J. R. SWALLEN, and J. P. E. MORRISON.

Chairman WELLS of the Committee on Meetings spoke of the final arrangements for the dinner meeting on January 15 at Hotel 2400.

The Secretary expressed the regrets of Chairman DAYTON of the Committee on Policy and Planning that he could not attend the meeting. He reported for the Chairman the receipt of a letter from Past President NATHAN R. SMITH recommending approval of affiliation with the Academy of the Society of Metals. Receipt of

this letter completes the unanimous approval by his committee. The Board on the basis of this recommendation instructed the Secretary to forward the required supporting material and ballot for affiliation of the Society of Metals to the membership.

Chairman McPHERSON of the Committee for the Encouragement of Science Talent reported that members of the Junior Academy had been guests of the Philosophical Society at the first Christmas Lecture of a series of annual lectures. This lecture, by Dr. EDWIN H. LAND of the Polaroid Corporation, resulted in very favorable comments and constituted an excellent initiation of this project for increasing the interest of youth in science. Twenty teachers have requested applications and examination blanks for the Westinghouse Science Talent Search. This year arrangements have been completed to include in this search the senior high schools in Virginia and Maryland within a radius of 25 miles from Washington, the area encompassing resident members of the Washington Academy. Approval of this arrangement has been received from the Virginia Academy of Sciences; the Maryland Academy is not at present actively participating in this search. Chairman McPHERSON mentioned that the Society of Chemical Engineers and the Washington Section of the Chemical Society are planning a demonstration lecture in February by Professor ALLEN of Princeton University. This meeting is designed to promote interest in science on a father-son attendance basis.

Chairman McPHERSON reported that the Seventh Annual Science Fair will be held at American University with one room devoted to Junior and another to Senior High School science exhibits. It is estimated that the cost of materials incidental to operation of the fair will be $1000, whereas contributions from the affiliated societies and others now total only $540. He requested action by the Board on a contribution by the Academy, and $200 was approved as a logical expenditure by the Board for this purpose.

The Secretary announced the deaths of the following members: MIRIAM L. BOMHARD on December 16, 1952, and ARTHUR B. LAMB on May 15, 1952.

The Treasurer reported on estimates from the Waverly Press for printing a new abridged form of Red Book. One thousand copies as planned would cost approximately $806; if the Constitution and Bylaws were omitted, the cost would be approximately $720.

Senior Editor FOSHAG submitted a preliminary report for the year, indicating an approximate unexpended balance of $204.05.

Vice-President McNISH outlined the desirability of equipping the Assembly Hall of the Cosmos Club with a better motion-picture projector. It is felt that the project is one for concerted action by the Academy and its affiliated societies. This matter is to be considered as unfinished business for action at the next meeting of the Board of Managers.

The Secretary suggested that the new Policy and Planning Committee give consideration to the affiliation of additional societies that have been suggested. The possibilities for affiliation of other societies have not been reviewed for about seven years.

The formal meeting of the Board adjourned at 9:40 p.m. to partake of refreshments provided by retiring President RAMBERG who thanked the Board and his committees for their cooperation.

F. M. DEFANDORF, *Secretary.*